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No. 7

CONFIDENTIAL

For official use only

Not to be taken into front line trenches

Issued down to include Machine Gun

Non-commissioned officers

MACHINE GUN TRAINING

Reprinted at

Headquarters, American Expeditionary Forces,
from

Training Memorandum No. 8

of June 15, 1917

Headquarters, Southern Department

OCTOBER 1917

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HEADQUARTERS SOUTHERN DEPARTMENT

Fort Sam Houston, Texas

June 15, 1917

TRAINING MEMORANDUM No. 8

—*—

MACHINE GUN TRAINING

BASED ON

Authoritative sources in the United States
and the latest obtainable information from
foreign sources.

PREPARED BY

“The School for Machine Gun Instructors”,
convened in compliance with General
Orders, No. 20, May 7, 1917, and Special
Orders, No. 127, Paragraph No. 4, May 8,
1917, Headquarters Southern Department
Fort Sam Houston, Texas.



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GLOSSARY

AIMING BAR (CROSS BAR OF THE AIMING POST) :

A horizontal bar, normally used in connection with an aiming post, for regulating distribution.

AIMING MARK (AIMING LINE, AIMING POINT, AIMING TARGET) :

An object, other than the target, upon which the gunner aligns his sights. Aiming marks may be features of the terrain, or suitable objects placed for the purpose.

AIMING POST :

A stake, either plain, or marked with special graduations, or painted with luminous paint, which is placed to indicate the azimuth of an invisible target.

ANGLE OF FALL :

The angular difference between the tangent to the trajectory at the point of strike and the horizontal.

ANGLE OF SAFETY :

The angle between the line of sight to target and an auxiliary line of sight short of the target, beyond which point it is unsafe for friendly troops to advance until the cone of fire is lifted.

ANGLE OF SITE (ANGLE OF POSITION) :

The angle that the line from gun to target makes with the horizontal.

AUTOMATIC RIFLE (MACHINE RIFLE : MACHINE GUN, LIGHT TYPE, LEWIS GUN) :

An easily portable weapon firing rifle ammunition automatically. The stability of its mount is limited by the fact that the gun and mount complete must be carried by one man. It is not capable of sustained fire. (*See MACHINE GUN.*)

BAND OF FIRE (BELT OF FIRE) :

Enfilade or cross fire from several positions, producing Bands or Belts of Fire, to check the enemy's advance over designated areas or to isolate him.

BACK SIGHT :

(*See Rear Sight.*)

BARRAGE (CURTAIN OF FIRE) :

A machine gun barrage is the combined sheaf of several guns at long range. It may be employed defensively, but, normally, is delivered over the heads of friendly troops to cover their advance. When it is moved forward by time table, or at a stated distance in advance of the leading elements of the attack, it is termed a *creeping barrage*.

BURSTS :

A term applied to a greater or less number of shots delivered automatically, between successive releases of the trigger.

CENTER OF IMPACT (POINT OF STRIKE, STRIKE, CENTER OF SHOT GROUP) :

The point at which the axis of the cone of fire intersects the ground.

COVERING FIRE :

Fire delivered to facilitate the movement of troops, and minimize their losses.

DESIGNATION :

The shortest and most easily understood description of an aiming mark.

DISTRIBUTED FIRE (TRAVERSING FIRE) :

Fire in which the barrel is moved through a horizontal arc, either by use of successive aiming points, measured angular changes of azimuth, or a continuous sweeping motion. The second is termed the tap method, and the last, the swinging traverse.

DUMPS :

An English term used to designate points where supplies are unloaded and turned over to line troops.

FIXED FIRE :

Fire in which the barrel is not intentionally moved.

GRATICULES :

Graduation lines in, or on, an angle measuring device.

MACHINE GUN (MACHINE GUN, HEAVY TYPE) :

A weapon firing rifle ammunition automatically. It is provided with a stable mount, suitable mechanism for controlling the motion of the barrel in elevation and azimuth, and is capable of sustained firing.

MASK :

An object, or a feature of the terrain, which prevents the gunner from seeing the target. Friendly troops which prevent firing on a target.

RANGING FIRE (RANGING) :

Fire employed preliminary to fire for effect. By observation of point of strike of ranging fire, the fire controller is enabled to order the corrections necessary to place the sheaf on the target.

REAR SIGHT (BACK SIGHT, TANGENT SIGHT) :

RECOGNITION :

The gunner's understanding of the exact mark at which he is to aim.

CHARACTERISTICS OF MACHINE GUNS :

Machine guns form an integral part of infantry and cavalry regiments, and a knowledge of their characteristics and uses is necessary to all officers, to enable them to realize :

1. — The kinds of tasks to allot to them.
2. — The kinds of assistance to expect from them.

The tactical employment of machine guns is based on their characteristics, and all are agreed that they should be used to closely support the arm to which they are attached.

By characteristics of any weapon, we mean its peculiarities, and a grasp of these is necessary to understand properly the tactical employment. The machine gun has many characteristics in common with the rifle, and some with the artillery piece. Like the rifle, same ammunition, same range ; like the artillery piece mounted on a fixed platform or rest, it is capable of delivering various classes of fire.

It has one characteristic, perhaps the most important, which is not possessed by any other weapon ; — its fire may be thrown on a target as if by hose, without alteration of the sights.

Its fire is, therefore, peculiarly applicable against our most difficult target — the moving target.

The Fixed Rest :

Effect of personal factor in holding reduced. Concentration of fire by close grouping. This gives opportunity for accurate observation, and increases safety of overhead fire and the effect of surprise. Range same as rifle, but effect at long ranges greater, though correct aim is

essential. Useful for night firing, as gun can be laid by day and used at night for : command of avenues of approach, sweeping parapets, catching reliefs or working parties repairing entanglements, etc..., firing on dumps, rendezvous, etc.

Results from demonstrations in peace with machine guns can, to a great extent, be relied upon as a guide to results obtainable in war. The Continental Powers agree to this. This is not so with the rifle. Germany divides peace rifle results by twenty. Only one man is firing the machine gun, where as many men are necessary to fire the rifles, and all have nerves to be considered.

Control is simplified, and the close grouping and highly concentrated fire are particularly suitable for surprise effect, and in the crisis of one fight. But, to be of use in the crisis, the machine gun must not waste its ammunition on targets that properly belong to other arms, and the guns must be close up and ready to deliver a heavy fire when wanted.

The disadvantage of close grouping is that widely extended targets are unsuitable for machine guns,—e.g., widely extended infantry. There will be occasions, however, when the targets will have to be engaged, and then the desired effect can be obtained by the employment of several guns. Suitable targets are those which are narrow and deep.

Rapid Production and Application of a Large Volume of Accurate Fire :

Guns can be laid ready for firing.

Maximum volume 400 rounds per minute (not 400 rounds in one minute), because after each burst or two, the aim must be checked, and the gun relaid. If firing about 300 rounds per minute,

roughly speaking, 25 men are equal to one machine gun. At long ranges the fire of one machine gun equals from 30 to 50 marksmen. The School of Musketry places a higher value of fire power for machine guns, as expressed in the following table :

« Fire power of one machine gun when firing at the rate of 100 shots per minute, expressed in terms of riflemen. »

Range	Men
200	15
400	18
600	22
800	29
1000	40

Note.—The fire power of the gun varies directly as the rate. For example, should the firing rate be 200 shots per minute, then the figures in the second column would be doubled.

For surprise effect upon *group targets*, the machine gun is greatly superior to rifle fire.

For fire on moving targets, no conclusive comparison is possible between rifle and machine gun fire.

One man receives and carries out the fire orders.

Fire can be suspended, re-directed, and redistributed instantly, and with sustained accuracy. Fire control being in the hands of one man, delay in indicating target, passing orders down a scattered line, setting 50 sights, etc..., is avoided.

This rapidity of production and application of fire assists greatly in surprise effect, which is one of the most important factors in war.

Narrow Front and Shallow Depth From Which a Large Volume of Fire can be Delivered :

Six square feet required for gun and crew. Only two riflemen could use their rifles properly in the same space. Can be used where the number of riflemen required for equal volume of fire could not be placed — as in street fighting, a defile, a cramped locality, enfilading a trench or line. Almost every position affords several small protected places from each of which not more than two or three riflemen could fire. These are frequently good machine gun positions. A machine gun is difficult to range on and hit ; can be brought into action unseen. Although firing discloses its presence, it does not necessarily disclose its location.

The all-round traverse :

This characteristic enables the gun to meet attack from any direction, with little or no movement or exposure. Compare this with changing direction of rifle fire. A sudden attack from a flank can be dealt with at once. This indicates the usefulness of machine guns on a flank, in a detached post, in a salient, or for engaging an enveloping attack by flanking cavalry or other troops, without increasing its vulnerability to enfilade fire, as is the case with extended infantry in similar circumstances.

Consider this all-round traverse when taking un a position in attack or defense, and also when making cover or intrenchments. It may sometimes be necessary to sacrifice cover to field of fire.

Invulnerability :

A gun in action offers a small target, hence is difficult to locate, and still more difficult to hit.

The difficulties of hostile artillery can be greatly increased by quickly changing position after a brief burst of fire. A gun occupies 1/25 of the front of 50 riflemen, and delivers same volume of fire. Full volume and accuracy of fire can be obtained even if 80 % of the gun crew are out of action, but mobility is reduced. Invulnerability depends largely upon invisibility. Guns should be posted with a view to concealment. In advancing, take same formations as troops. By this means, you may often get close in without being identified, and thus have full fire power available for a crisis of the fight.

Guns are entirely helpless when marching, but can be brought into action very quickly. The latter quality, coupled with the short road space occupied in porportion to great fire power available, makes the machine gun a very important element in advance guards where strong resistance is anticipated.

Mobility :

Machine guns can go anywhere that a man on foot can go, and thus are able to closely support infantry in country of any nature. In close and hilly country, machine guns will often take the place of artillery, when the ranging power and ability of that arm can no longer be used for close support, as between ranges of 1500 and 800 yards, where rifle fire is least effective. In other circumstances machine guns should never attempt to act as artillery. Machine guns with pack transportation can go wherever a mounted man can go. Machine guns are particularly valuable as a mobile reserve to strengthen threatened points, meet unexpected situations, etc...

Liability to Accidental Cessation of Fire (an adverse characteristic) :

Machine guns, like all mechanical instruments, are liable to get out of order. Stoppages are classified :

1. Avoidable.
2. Unavoidable.
3. Temporary.
4. Prolonged.

1. The first is due to carelessness or ignorance.
2. The second to some minor breakage or fault of ammunition.
3. — « Immediate action » will cure at once.

One gun may be put out of action, but the other gun of the platoon can continue to fire. This is one of the reasons for not separating the guns of a platoon, as a rule. The use of single guns should be regarded as exceptional. (They may be far enough apart to escape destruction by one shell, and still be under one control.)

In our service, each platoon is equipped for action independent of the company.

This adverse characteristic requires a *high state of training of the personnel*. It must be borne in mind that the gun has but one power — *fire* — and if it is deprived of this by inability of the crew to maintain it in operation, it is worse than useless.

With due regard to the tactical requirements, the following should be kept in mind :

- a) Surprise effect.
- b) Suitable targets.
- c) Decisive action.

Machine guns fire too much, as a rule. *Their fire should be reserved for the crisis of the fight.*

Noise of Firing (Sometimes an adverse Characteristic) :

It is an unmistakable sound, but, on the battlefield, there are many noises which tend to neutralise it. Wind, and the sound of bullets, will often cause the sound of firing to seem to come from a different direction from the true one. The sound is very disconcerting to troops being fired at, and is correspondingly stimulating to our own troops.

Machine guns have been found easier to locate by sound when they are in the infantry firing line, than when they are on its flank. In the line, they are likely to draw artillery fire to contiguous troops. Prolonged bursts of fire render it easier for the enemy to locate the guns.

At night, the flash may disclose the position of the gun. Alternative positions are necessary. Great skill is needed in reconnaissance and choice of fire positions.

By day, free and rapid traversing impedes discovery. Cross fire renders location of the guns almost impossible.

Summary :

Prolonged firing causes a heavy expenditure of ammunition, a tax on the mechanism, and overheating of the barrel, with consequent loss of accuracy.

Full use should be made of the ground suitable for machine guns. Their fire power is best used for surprise effects, and to develop heavy bursts of fire against important targets, and for decisive action.

It is valuable for use against moving targets, for night firing, for indirect firing, and as a mo-

bile reserve. *It is a weapon for which opportunities should be made.*

Volume and concentration of fire necessitates large and vulnerable targets to avoid waste of ammunition. When in doubt as to the employment, think, « Shall I get full value for my fire? » and « Am I going against the characteristics of the gun? »

The action must not be guided by machine gun requirements, but the machine gun action by the requirements of the arm with which they are serving.

II

SELECTION AND MECHANICAL TRAINING OF PERSONNEL :

In order to have a dependable machine gun force which can obtain the best results from the guns, a highly trained personnel is necessary. Officers and men must know their guns thoroughly. They must understand both the *theoretical* and *practical* sides of machine gun employment, as well as the theory of machine gun fire, and the trajectories of bullets at the different ranges.

The personnel should be carefully selected. The officers must be intelligent, resourceful, bold, and must have good judgment. The work is hard, so the men must have superior physique. They should be able to run or crawl from position to position, carrying gun, tripod, or ammunition. Those unable to do this, or without staying qualities, should be transferred. They must have good eyesight. It has been the experience abroad that machine gun units should be composed of men with a mechanical turn of mind. In addition to the above qualifications, the

men should, of course, be intelligent and have some education, otherwise they will not understand the range and elevation tables and the theoretical side of machine gun fire and of trajectories of bullets. Men selected for machine gun service are chosen as far as possible from men having six months to one year's service in one of the other arms. Others selected are very promising men from training centers, who have completed their preliminary training and are ready to take up machine gun work at once.

Officers and men found unfit for machine gun service are relieved at once.

Every member is trained in such a manner that he can serve on any duty or position at the gun.

After all are trained, the most efficient are appointed gunners and so serve. All officers and non-commissioned officers must be expert in the operation of the machine gun as well as in its theoretical and mechanical employment.

In the scheme of instruction, the soldier is first given training in the nomenclature, functions of parts, and operation of the piece and also in its care, preservation and repair.

The correct method of using the sights is then taught and, at the same time, certain physical exercises are taken up with a view to developing those muscles which will be called upon to play a part in the act of firing. Nothing is better than running and crawling considerable distances with gun, tripod and ammunition over all kinds of ground, and mounting it in all positions.

These preliminary exercises are most important in that they assure the mental and physical equipment of the individual, which is prerequisite to further progress.

The officers, non-commissioned officers and privates of machine gun units must be experts in everything connected with the machine gun. They should be required to take the gun apart and to assemble it again and again, until this becomes second nature. They should be quizzed and lectured about causes of stoppages and jams until the ability to locate these and to remedy them becomes second nature. Likewise they will be taught to clean, oil, and care for the gun and all of its parts, to adjust, read, and set the sights, to load the ammunition strips and belts; load, fire and unload the gun, to feed the gun and to pack and unpack gun, tripod, ammunition and all accessories. Not until such intimate knowledge is possessed by each member of the detachment can it be considered ready for the advanced work of machine gun employment. (S. of M. No. XII, pp/ 1-8.)

III

DRILL. — FUNDAMENTAL TRAINING :

This includes the following :

The instruction in detail of each man in the gun squad in his special duties. The positions in the gun squad should be interchangeable, and the men trained accordingly.

Nomenclature of the Gun :

Functions performed by each part separately, and in conjunction with the other parts, both in forward and backward motions (handbooks of the gun used).

Stripping and Assembling Gun :

Changing parts. Care and cleaning. Loading and unloading. Loading belts, strips or magazines

(handbooks). Inspection of guns to ascertain readiness for use.

Stoppages and Jams :

Locating causes and applying remedies. *This is very important.* Every possible kind of stoppage should be artificially brought about, and a study made of the proper method of reducing same.

Instructions in adjustment of gun for firing (such as gas regulation and spring tension).

Sighting exercises in connection with the manipulation of elevating and traversing gears. (S. of M. No. XII.)

Visual Training :

Estimation of ranges. Designation and recognition of targets. Use of B. & L. Range Finder. The mil measurement. Use of field glasses with mil scales and inverted sight scale. The use, care and adjustment of the telescopic sight. Preparation and use of range cards. (S. of M. No. VI. — S. of M. No. II.)

Drills in Fire Control :

Drill in hand and arm signals for the control of fire; and semaphore signals for observation of effect of fire. General semaphore drill can be combined with physical drill.

Drill of ammunition crews : Drill in movement of complete equipment of gun, ammunition, and accessories, by hand, under cover, to selected points.

Drill in selection of positions, and routes thereto ; preparing emplacements, dugouts, bomb-proofs, etc.

Instruction in the care of pack animals, in packing, or the use and care of other means of transportation.

After individual training, the gun squad is trained as a unit, and then gun squads combined, by platoon and company.

Formal drill for maneuver.

Machine gun marksmanship courses (S. of M. No. XII.) Pistol course. Instruction in handling bombs, grenades. Gas protection.

Field Firing.

IV

METHOD OF FIRE CONTROL :

The principles governing fire direction and fire control are discussed under the heading of "Technique of Fire "

The fire of a machine gun, on account of its great volume and concentration of sheaf, must be under perfect control, in order to avoid enormous expenditure of ammunition, with little or no corresponding effect.

The control of fire divides itself into :

- (1) Estimation or determination of distance.
- (2) Designation and recognition of reference points, aiming marks, and targets.
- (3) Adjustment of fire on targets — fire orders.
- (4) Movement of the sheaf to various parts of the target, or the other targets.

(1) Distance is estimated by eye. It is determined by measurement, range finders, sound, map, or information. (For ranging fire, see (3). (Reference, Small Arms Firing Manual, S. of M. V., revised, p. 20. — S. of M. II.)

(2) *Designation* : "The shortest and most easily understood description of an aiming mark. "

Recognition : « The gunner's understanding of the exact mark at which he is to aim. »

Proficiency in designation and recognition is dependent on *visual training* of the personnel. Men must be practiced in this work with the naked eye, range finder, telescopic sight, and field glasses. (Reference, S. of M. VI, p. 27, and plates.)

Reference points should be prominent and unmistakable landmarks.

The use of an auxiliary aiming mark, even in direct fire, usually results in more rapid and accurate laying and re-laying by the gunner, than if the target itself is used as an aiming mark. The attention of the gunner is fixed on his sights and aiming mark, and he is not distracted by having to follow his target. The aiming mark should provide a definite outline, or a strong contrast of color.

The designation of aiming marks and targets, and their location with respect to the reference point, is governed by the methods prescribed in S. of M. V, revised.

(3) Fire is adjusted on targets in accordance with the methods prescribed in « Technique of Fire ».

Fire Orders are given either verbally or by signals.

In preparing to adjust fire on any target, the range should be given first. This should be followed by the information necessary to the recognition of the target. The target, or aiming mark, should be given last. (S. of M.V. revised. — S. of M. XI, p. 79 et seq.)

The personnel should be thoroughly trained in military phraseology. This instruction can best be taken up in *Visual Training*.

Transmission and Passing of Orders :

Training in transmission of orders impresses upon the soldier that it is his duty to make certain that all orders passed are received and understood by those for whom they are intended. Men will be trained by first arranging them in a circle, and issuing simple orders to be passed from one to the other, to test understanding and accuracy in memorizing. Subsequently orders will be made more complex, and later, orders as transmitted will be carried out by firing, to test the accuracy of transmission.

When a gun is in action, the attention of one member of the gun squad should be fixed on the fire controller, in order to receive and transmit fire orders. He can attract the attention of the gunner by tapping him on the shoulder.

When verbal orders cannot be used, fire orders are given and transmitted by signals. Systems of signals are to be found in S. of M. No. 3, and in the Drill Regulations. The following, which have been found necessary, are recommended in addition to those prescribed in the works to which reference is made above.

Signals for Observation and Control of Fire :

« At no time more than in the present war has the need for signals been more keenly felt. The noise is often so great that a man can hardly hear himself shout, let alone convey his wishes to his gunners. »

Arm and Hand Signals :

Action. — Strike with closed fist in direction indicated. (This signal is used when gun crews are in a position in readiness, or are resting

during pauses in an engagement, etc. At signal, crews take positions at guns.)

Out of Action. — Strike the open palm of one hand with the closed fist of other hand. (Signal indicates gun is out of action or not ready to fire.)

Ready to Fire. — Hand up. (No. 1. or Platoon Chief.)

Prepare to fire. — Hand up. (Machine Gun Officer.)

Fire : Drop hand smartly from prepare to fire or ready to fire. As a simultaneous burst of fire is essential to the maximum of effect, all the indicated guns open fire instantly upon this signal.

Range : Thrust the closed fist to the front once for each 500 yards, and upwards once for each 100 yards. (If but one platoon or gun is to fire, the thrust should be made toward that platoon or gun.) Owing to the increase in number of guns used, and consequent extension of fronts, the finger signals for range cannot be read. The above described signals have proved satisfactory in the light of experience.

Up Mils : Extend the arm to the front and downwards, palm up, and wave upward with a full swing of the arm. Indicate number of mils by thrusting closed fist to the front once for each five mils, and upwards once for each single mil. Thus, for four mils, thrust upward four times ; for six mils, thrust to the front once and upward once.

Down Mils : Extend arm to the front, palm down, and wave downward. Indicate number of mils by thrusting closed fist to the front once for each five mils, and downward once for each single mil.

Deflections in Mils :

To the Right Mils : Extend arm to the front and wave to the right. Indicate mils as in UP.

To the Left Mils : Same as above, substituting LEFT for RIGHT.

Distributed Fire : Extend arm to the front, palm to the left or right, and wave the hand up and down with a chopping motion, at the same time moving the hand arm from right to left or left to right, as it is desired that the fire be distributed.

Semaphore signals for use in conveying information of the results of observation of fire :

OK. . . . Correct range.

C. . . . Correct direction.

U. . . . Unobserved. Repeat in order that observation may be made.

Q. . . . Fire observed. Uncertain.

Every man in the company, including officers, should be trained and efficient in the service of information. (S. of M. No. 3, pp. 14, 15, 16-20, 26-29.)

(4) The movement of the sheaf is much more easily accomplished than is the case with the collective sheaf of a number of riflemen.

The methods are the same as described in (3). In order that the will of the fire controller may be promptly and correctly carried out, a high state of fire discipline is necessary. Gunners must be proficient in recognition of aiming marks, and the manipulation of elevating and traversing mechanism.

Examples of Fire Orders :

1. With *aiming mark*. Fire order for *ranging fire*, followed by *fixed fire for effect*.

RANGE THIRTEEN HUNDRED.

REFERENCE POINT, AT TWELVE O'CLOCK
STONE HOUSE LONE CHIMNEY.

AIMING MARK AT THREE O'CLOCK TWO
HUNDRED MILS SKY LINE V SHAPED
NOTCH.

PREPARE TO FIRE (Signal).

UP TEN MILS (Signal).

O K (Signal).

FIRE (Signal).

2. *Target* used as aiming mark. Fire order for *combined sights*. (The original range, as given by the fire controller, is the shortest one, and is used by the flank gun nearest to him.)

RANGE THIRTEEN HUNDRED, DIFFERENCE,
ONE HUNDRED.

(Gunner nearest flank gun repeats « Thirteen hundred, difference, one hundred », and sets his sight at thirteen hundred, or its proper equivalent for the barrel in use.)

(Gunner of next gun repeats, « Fourteen hundred, difference, one hundred », this transmission of orders being carried from gunner to gunner. If, for example, there are six guns in action, the one on the far flank will start firing with a sight setting of eighteen hundred, or its proper equivalent for the barrel in use.)

REFERENCE POINT AT ONE O'CLOCK RAIL-
ROAD BRIDGE NINE O'CLOCK END.

TARGET, AT EIGHT O'CLOCK ONE HUNDRED
FIFTY MILS GROUP OF LED HORSES.

BURSTS OF THIRTY. (There will be no ranging
fire. Fire for effect will be opened at signal, and
will be maintained in bursts of thirty rounds.)

PREPARE TO FIRE (Signal).

FIRE (Signal).

CEASE FIRING (Signal).

3. With *aiming mark*. Fire order for *ranging fire* followed by *distributed fire for effect*.

Target Divided.

RANGE TWO HUNDRED. (This has been obtained with the graticules.)

REFERENCE POINT AT ONE O'CLOCK. FLAT
TOPPED HILL BARE SPOT TWO TREES.
AIMING MARK AT SIX O'CLOCK TWENTY
MILS TOP OF STONE FENCE.

DIVISION OF SECTORS FROM POINT BELOW
TREES, FIRST PLATOON RIGHT TO FENCE
CORNER ; SECOND PLATOON LEFT SIXTY
MILS.

PREPARE TO FIRE (Signal).

FIRE (Signal).

UP EIGHT MILS (Signal to 1st platoon).

UP TWELVE MILS (Signal to 2d platoon).

O K (Signal to both platoons).

DISTRIBUTE YOUR FIRE (Signal to both platoons).

V.

MACHINE GUN RECONNAISSANCE AND LANDSCAPE SKETCHING TRAINING OF SCOUTS AND AGENTS OF COMMUNICATION

(Reference S. of M. VI, pp. 18 et seq.)

VI

TECHNIQUE OF FIRE :

For « *The Theory of Fire* » see S. of M. No. IV.
This theory requires modification to suit the
characteristics of machine guns.

The use and care of instruments : Special attention should be devoted to the EE field glass with mil scale and inverted rear sight scale, as these two scales are used in nearly all machine gun firing. (Study thoroughly the subject of the mil, and make constant use of it.) (S. of M. 2.)

Become thoroughly familiar with the service B. & L. 880 cm. range finder. This is a valuable instrument. Learn how to use it, how to range on moving targets, how to obtain ranges at night, how to use it as a periscope, etc.

Study the sights of the gun, rear and telescopic. Learn how to adjust the telescopic sight. It is a six power field glass. The gunner has only to lay the intersection of the cross on the target. Indistinct targets are often readily picked up with this sight. Auxiliary aiming marks are picked up with ease.

For night firing, the glow of a lighted string will illuminate the cross. The telescopic sight may be adjusted to the barrel used, so as to read correct ranges.

Make use of the rear sight as an angle measuring device.

Familiarize yourself with the trajectory and tables of departure and fall, etc. (Ord. Pamphlet No: 1923, United States Rifle.)

With whatever machine gun your organization is armed, study the parts of the mechanism, with a view to determining mil measurements, especially the value of two mils vertically, and two and one-half mils horizontally. The 75 % zone marks the useful or effective part of the machine gun sheaf. The angular difference between sight readings in searching is measured by the vertical diameter of the 75 % sheaf. « This measurement, when reduced to mils, will vary

with the vertical dispersion of the gun, which, in turn, will vary for different types of guns and mounts, and, for shoulder guns of the Lewis and Benet types, will vary according to the degree of skill of the gunner. For the Benet gun in the hands of a gunner of average skill, the measure of the vertical 75 % zone is 2 mils. »

In distributed fire, successive *aiming* points must be close enough together to insure that the target will be covered with fire. The lateral interval between aiming points at a continuous dense line, is the width of the 75 % lateral zone. « This measure, if taken in mils, is practically constant for all ranges. It varies with different types of guns, mounts, and degree of skill of the gunners. With a Benet gun, in the hands of a gunner of average skill, the angular measure of the width of the 75 % zone, may be taken as $2 \frac{1}{2}$ mils. »

The mil scale of the field glass may be used to lay out a scale of mils. This in conveniently done by placing the field glass on the gun. With the Benet gun, one turn of the hand wheel (radical arms), of the elevating mechanism, is equivalent to 16 mils. For lateral measurement a mil scale may be marked on the elevating mechanism guide rod. With the rod at right angles to the stock, fairly accurate measurements can be laid off.

One turn of the traversing hand wheel of the Vickers-Maxim (Model 1904) traverses the gun through an arc of 15 mils. One turn of the elevating screw is equivalent to 70 mils.

One click of the elevating screw of the rear sight of the 303 Lewis is equal to an angle of one mil. With the eye in normal sighting position, and looking through the peep, the distance between the exterior faces of the wings of the

front sight measures 20 mils, and between the interior faces, 15 mils. The blade of the front sight is 5 mils in height from the top to the shoulder.

Remember that the sheaf of fire of the machine gun is dense, deep, but narrow; that when you hit, you hit hard; that it is easy to miss entirely; that nothing is so useless and wasteful as poorly directed or controlled machine gun fire.

Adjustment of Fire :

The Machine Gun as a RANGE FINDER :

Adjustment of fire is based on observation of impact, or of live targets. Ranges, as found by the range finder, are not always correct. The instrument may not be in adjustment. The range taker may be careless, or unnerved, or a high wind may be blowing, which may make it impossible to use the instrument with even a fair degree of accuracy. If the correct distance to the target is found by the range finder, the sight setting will vary, according as the target is above or below the horizontal plane of the gun. It will also vary with the wind (force and direction) and the barometric pressure (weather and elevation with respect to sea level). Observation of impact, and of the target, are as important in delivering machine gun fire, as in delivering artillery fire. The rule in the artillery is, "The gun is, after all, the best range finder."

It is obvious that ranging fire should not be employed when within battle sight range, or when surprise effect is desired. Single shots may sometimes be employed for ranging. The advantage of this method of ranging is that the

presence of machine guns is not disclosed. If fire for effect is to follow, guns not employed for ranging with single shots should be held ready for immediate automatic fire. From 5 to 20 shots, depending upon the range, the nature of the ground in the vicinity of the target, etc., fired automatically, are generally required for ranging. When unable to observe the impact from one gun, two or more should be used for ranging. Training in observation of fire, and the use of field glasses, are necessary prerequisites to successful adjustment of fire.

Searching for Range :

Procedure: Lay the gun on the target with the sight set at the estimated range. Open fire, and while firing, manipulate the elevating and traversing mechanism, until the center of the shot group is on the target. The gun is then clamped, and the line of sight brought to bear on the target. The proper sight setting may now be read on the rear sight. Searching for range should preferably be fired in bursts of from 10 to 25 rounds.

Automatic Adjustments :

For the theory upon which these adjustments are based, see S. of M. No. 2. In practice, it has been found that when firing upon ground rising with a slope of 45 to 90 degrees with respect to the line of sight, no corrections are necessary other than aligning the sight on the lowest point of the shot group, if it is below the target, or the highest point, if above the target.

Method :

Set sight at the estimated range. Lay gun on target. Fire a burst of about 5 shots, grouping

as closely as possible. If, due to vibration, the line of sight is thrown off the target, re-lay the gun and clamp it. While holding, have an assistant move the sight slide until the line of sight is on the shot group. The correction is now complete, and the gun is ready to be re-laid on the target and fired for effect. If the target is on level ground, or on ground with a slope rising less than 45 degrees with respect to the line of sight, then, to the vertical correction as made above, must be added the estimated horizontal distance when the center of impact is short, or subtracted if it is over. This, in yards, from the center of impact to the target.

Practice in range correction, by means of automatic adjustments, is a very valuable exercise. It gives practice in estimating distances, laying the gun, holding, and sight manipulation.

The inverted rear sight scale in the EE field glass, is the handiest device for the officer or non-commissioned officer with which to make an automatic adjustment. The principle involved in the use of this scale is the same as governs the use of the rear sight, in the way above described. The graticule corresponding to the estimated range is lined on the target, and the graticule crossing the shot group, corresponds to the range at which the rear sight should be set, after making the additional correction for ground which has a slope of less than 45 degrees.

Mil Adjustment for Range :

With the sight set at the estimated range, fire a burst and note the point of strike. With the EE glass, or mil rule, measure the angle, short or over, in mils, and direct the gunner « Up, two (four, six) mils », or « Down two

(four) mils. » The gunner, by operating his elevating mechanism, *without reference to his sights*, elevates or depresses the number of mils directed. He then clamps the gun in position, and brings the line of sight to bear on the target, *without moving the gun*.

Measurement of Deflection (Windage) :

When observation of impact is possible, lateral deviation, due to wind or other causes, can be measured.

Method : After firing a burst, clamp the gun with the line of sight on the target, then while holding firmly, have an assistant turn the windage screw until the line of sight is on the point struck. The correction is now completed. Re-lay the gun on the target.

The mil scale in the field glass is the simplest and quickest means for measuring deflections. One point of windage is equal to 1-1/6 mils, but, for all practical purposes, consider one point equal to one mil. (Telescopic points are 1/4 of rear sight points.)

The measurement of deflections with the scale in the field glass will enable the fire director to deflect his fire the full limit of the windage scale. By using the *same* aiming mark, valuable time may often be saved, by avoiding the necessity of securing recognition on the part of the gunner of nearby or indistinct targets.

Vertical Searching :

To cover an area in depth : The range to the near end of the target or ground to be searched in depth, is placed on the sights, and the gun is laid on the near end of the target ; then, without

altering the elevation of the gun, alter the sights to the range required to strike the far end of the target. Your line of sight will now be short of the target. Select or place an aiming mark in the line of sight. Fire should now be opened, and, after every burst of fire, elevate your gun by turn of wheel sufficiently to make each zone overlap the one previous to it. A turn of 2 mils will insure the zones' overlapping. Firing and elevating is continued until your line of sight comes again on to the near end of the target. The target has now been searched in depth, but, if you wish to continue the searching, depress the muzzle and fire bursts until the line of sight is back on the auxiliary aiming mark.

In case you are searching with two guns, one gun may be laid on the far end of the area or target, with the range to that end of target on the sight, then, clamp the gun and move the sight slide down the amount in yards between the far end and near end of the target, and search downward until the line of sight is on the *near end* of the area or target.

In the second method, when gun can be laid on far end of target, and sight lowered to near end, the target is searched with 100 % of fire. When the far end of target cannot be seen and the gun is laid on near end, as in first method, the entire area will be searched, but the far end will not receive the full 100 % of shots.

Several guns are usually employed when searching an area.

The Mil Method for Searching a Target in Depth :

The range to the target having been found by the range finder, or by observation and mil elevation, and the depth of the target measured in

mils, the line of sight is laid on the head of the target, or an aiming mark in advance of the target, and « search (6) mils up » is commanded. The gunner fires in bursts and while firing elevates 2 mils to each burst. Searching « up » is usually employed on a target coming towards you, and « down » on a target moving away from you. Always lay the gun with the line of sight on the head of the target, or aiming mark in advance of the target, and search up or down, according as the target is moving towards or away from you.

Distributed Fire :

The object of distributed fire is to secure an even distribution of fire throughout the entire width of a linear target. The cones of fire (75 % cones) should overlap and leave no gaps. This distribution is accomplished by traversing $2\frac{1}{2}$ mils with each burst.

It has been found by experience that it requires about one belt of ammunition (250 rounds) to traverse 50 yards in one minute.

Distributed fire, using successive aiming points, is the normal method. Distributed fire by « sweeping » is used for surprise effect, to stop rushes, and in all cases where time is the important factor.

Searching with distribution is constantly occurring when a machine gun is firing.

Blanket Fire, so called, is a form of searching with distribution in which a designated area is covered systematically with fire.

Cross fire is employed to obtain the effect of enfilade or flanking fire, and to deceive the enemy

as to the positions of the machine guns. Cross fire is the rule and « frontal » fire the exception.

Belts or bands of fire. Cross fire is employed along the entire sector to be covered, forming one or more belts of fire.

Auxiliary aiming marks :

(S. of M. No. 2.)

Method of Adjustment for Machine Guns :

Gun and tangent sight : With the true range to the target on the sight, lay the gun with the line of sight on the target and then clamp the gun (elevating mechanism) in place. While holding firmly, have an assistant move the sight slide and windage screw until the line of sight is on the desired aiming mark. Note the auxiliary sight setting so that, should the slide slip, the gun may be re-laid upon the aiming mark without delay.

Gun and Telescopic Sight : The method is similar to the tangent sight method, the assistant (No. 2) turning the range dial, or range and windage dials, of the telescopic sight, until the intersection of the cross is on the auxiliary aiming mark.

Auxiliary aiming marks may be picked up by throwing the trajectory on to the target by the elevating mechanism, then clamping the gun in position, and picking up an aiming mark by moving the sight slide up or down as desired.

For instance, when firing in the mesquite region or in high grass, the gunner is often unable to see his target. If observation is possible, the gunner may lay his gun, with the line of sight approximately on the target and fire a burst for

observation. If the impact is observed, the fire director measures the distance from impact to target, in mils, and directs the gunner « up » or « down » the number of mils measured. By turn-of-wheel the gunner makes the correction ordered, then clamps his piece and moves the sight slide until he picks up an « aiming mark ». This work is constantly occurring in field firing.

Auxiliary Aiming Marks with the Sight Scale in the Field Glass :

The graduation or graticule corresponding to the true range to the target is lined on the target, and the graticule that crosses the aiming mark represents the sight setting that should be used, when aiming at the auxiliary mark, to cause the trajectory to hit the target.

When using this inverted sight scale, your eyes should be on or near the level of the gun sights.

Make full use of this scale and the mil scale, and the gun mechanism for measuring mils.

A thorough knowledge of the subject or auxiliary aiming and practice in picking up aiming marks by the gun crews and those charged with fire direction are prerequisites to advanced training in the technique of machine gun fire.

Auxiliary aiming marks are employed in night firing ; overhead covering fire ; indirect fire ; fire on indistinct targets, etc.

OVERHEAD COVERING FIRE (DIRECT)

The demands of modern war require that the attacking troops be protected during their advance by covering fire from the artillery and machine guns. This covering fire may take the

form of what is known as Barrage or Creeping Barrage — a slow steady advance of covering fire ahead of the assaulting troops.

Overhead fire may be employed over our troops in trenches, to assist in gaining fire superiority or to cover the withdrawal of our troops in case of retirement.

There are certain limiting conditions which must be considered before employing overhead fire. Machine guns of the watercooled type, on stable mounts, not automatic rifles, should be used for this fire.

The flat trajectory necessarily restricts overhead fire at the closer ranges, if the gun position, friendly troops, and enemy are approximately in the same plane, while at the longer ranges the dispersion of the cone of fire and difficulty in ranging make it dangerous.

Good barrels must be used.

The tripod must have no lost motion in a vertical direction. Great care must be exercised to prevent the depression of the muzzle below the safety point. The ground upon which the tripod is mounted must be firm and solid. The target must be visible to the gunner and to the controlling officer.

The gunner must be an expert machine gun operator. Overhead fire should be employed from, or at a commanding position, or across a valley; but not when the gun, friendly troops, and target are approximately in the same plane.

Direct overhead fire should normally be employed between the ranges of 800 and 1500 yards.

(The height of the 800 yards ordinate of the trajectory at 500 yards is 7 feet above the line of sight. The height of the 1500 yards ordinate at 800 yards is 52 feet above the line of sight.)

The troops over whom overhead fire is to be directed must be notified as to the hour and probable duration of the fire.

In barrage fire the « lifts » are arranged in the time table.

When overhead *indirect* fire is employed, the fire must be kept 400 yards in advance of our troops.

To obtain a definite limit of safety we consider the lowest shot of the 100 % cone; 5 % for errors in ranging; and allow 10 % for other factors. This gives us a margin of safety of 15 %.

For ranges of 1000 yards and under and up to 1500 yards, this margin of safety is obtained by angles of 30 minutes and 60 minutes respectively. These are « safety angles » and are measured vertically between the line of sight to target, and an auxiliary line of sight short of the target, beyond which point it is unsafe for friendly troops to advance until the cone of fire is lifted.

The firing data and safety angles must be checked in person by the company commander and the double-check system employed, i. e. the tangent sight method must be used, and the fire controller must check the accuracy and the control of the fire with graticuled glasses or other means.

Methods of Obtaining Safety Angles :

(a) Tangent sight method : Lay the gun on the target with the correct elevation for that particular gun (*found by trial shots*), and clamp the gun in position. Move the sight slide « up » 400 yards and adopt an auxiliary aiming mark found in the line of sight, as the limiting line to which the friendly troops may advance with safety, while the covering fire is on the target.

There is a different safety angle for each range and, with our ammunition, moving the slide up 400 yards for all ranges between 800 and 1500 yards gives us the required safety angle, besides, it is easy to remember. When the heads of our troops touch the limiting line, the gunner should continue firing and elevating his line of sight so as to keep it on the heads of the troops as they advance. By these means, covering fire is maintained until the attacking troops reach the enemy's position. The cones of fire pass over the heads of the friendly troops, with a margin of safety at each advance, and search ground in rear of the position, forming a curtain of fire and possibly reaching supports and reserves. If the line of sight is immediately lifted to the target, the covering fire may be thrown well in rear of the enemy's position, and he may open short range fire on the assaulting troops.

The ammunition in belts must be checked to insure a steady flow and to maintain the required volume of covering fire during the attack, and for a possible retirement in case the attack is unsuccessful. The fire controller should constantly check the gunner, using his field glasses for the purpose.

(b) The field glass with mil scale is the most accurate field device for the fire controller for checking the safety angle and controlling the fire of his gun.

10 mils subtends an angle of 33 minutes, and 20 mils subtends an angle of $1^{\circ} 5'$.

(c) From the type EE field glass with inverted rear sight scale. The distance between the zero line and the 800 yard line subtends an angle

of 32 minutes plus, while the distance between the zero line and the 1200 yard line subtends an angle of $1^{\circ} 8'$.

(d) By a machine gunner's protractor or card and string method. Required: a piece of cardboard and a string of any convenient length. If the string is 24 inches long, the angles required, 30 and 60 minutes, are measured by the distance between horizontal lines drawn on the card, 21 inches and .42 inches apart respectively. If the string is 27 inches long, these spaces between lines should be .23 and .47 inches respectively.

Holding the card vertically, and at full length of string from eye, place the zero line on the target. For ranges under 1000 yards the 30' line will give the safety angle, and over 1000 yards to 1500 yards, the 60' line marks the angle of safety.

INDIRECT FIRE:

Conceal your guns — act by surprise. The golden rule in the employment of machine guns. Unless machine guns are concealed they are soon put out of action.

In the artillery, indirect fire is the rule — direct fire the exception.

Observation of the effects of fire — especially machine gun fire — is all important, and where we are unable to observe the effects of fire we have to rely on the best data obtainable.

Where observation is possible, indirect fire may be conducted as simply and quickly, and with greater accuracy than direct fire, provided the fire director is a trained observer and the gunner an expert. When using direct fire, the gunner is constantly watching the effect of his

shots and switching his eyes between sights and target; the vibration of the gun and excitement of the action influences the holding, and consequently the accuracy. Indirect fire places the control of the sheaf in the hands of the fire controller or director, who, working calmly, controls and directs the fire.

Advantages: The company may come into action unobserved under cover of the mask. The men and material are under cover, at least from direct view, and from direct fire. The gunners work with comparative freedom and safety, and, therefore, more quietly. The supply of ammunition is simplified. It is more difficult for the enemy to discover the position of the guns, and to direct fire upon the guns and personnel. Positions of guns may be changed without observation by the enemy. Ability to act by surprise; greater field of fire. Natural cover may often be used, thus actually opening fire in less time than when cover for direct fire must be constructed. It is possible to employ long range searching fire upon the enemy's communications. The flash of the guns at night may often be concealed behind the mask.

Disadvantages: The ground in the immediate front of the mask is not covered by the guns firing over the mask. This ground must, therefore, be held or covered by other troops or machine guns. Moving targets cannot be covered with fire as readily as when direct fire is used. Generally more time is required to lay the guns.

As we must conceal our guns and cover them both from view and fire, we must constantly be on the lookout for indirect fire positions. Even in the prairie and mesquite country, indirect fire often has to be used, as the tall grass and mesquite frequently obscure the target from view.

Positions must be carefully selected to give the desired defilade and the required command. Provision must be made for covering dead space in front of the mask; preparations made for moving the guns forward to the mask for direct fire. Data must be at hand to cover selected ground, other than the original target, with fire. Other positions must always be selected, in case the present position becomes untenable. Good judgement and care must be exercised in selecting observing stations, and these stations should be selected with a view to observing the effects of fire and rapid communication with the gun commanders. Parallax must be worked out for the gun position and observing station. (See Parallax, S. of M. No. XIII.)

If the slope of the mask is very steep, the guns may be pushed up close to the crest, but on a gentle slope the guns must be placed sufficiently to the rear to avoid the forward effect of shrapnel bursting on the crest line.

The methods for employing indirect fire vary according to the range, the position of the gun, distance of mask from gun and from target, and the difference in level between gun and target. Data for indirect fire may sometimes be obtained from maps, provided that accurate, large scale maps are available.

In taking up the study of indirect fire, first study the subject of the trajectory and its em-

ployment in direct fire. (It is assumed that the student is familiar with instruments and field glasses.)

The subject of *auxiliary aiming marks* is the next important step, to be followed by the simplest and most generally used methods of indirect fire.

Method by Observation: Where observation of the target and the strike of the bullets is possible, indirect fire may be directed by the same methods as direct fire. Find the range, and lay the gun with the line of sight directed toward the target and fire a burst for observation. Correct with the mil and sight scales in the field glass as when ranging. When the bullets strike the target, clamp the gun and move the sight until the line of sight is upon some suitable natural aiming mark or an artificial mark placed for that purpose.

Graticule Method: By means of the graticule method, I. E. (Inverted Rear Sight Graduations) as ordinary direct fire.

The type EE field glass, or a protractor, on graticule card and string may be used. The field glass is more accurate and should be used, if available.

1. Obtain range to target.
2. Move to a flank or slightly forward and observe the target through field glasses, so that the graticule representing the range to the target falls across the target, and, while holding the correct range graticule on the target, note a suitable aiming mark above the target which can be seen by the gunner, and note the graticule

that falls across it. Place the gun behind the mask where the gunner can see the aiming mark, but not the target. Set the sights to the range corresponding to the aiming mark, and aim at the aiming mark. After laying gun on aiming mark, clamp it in position and insure that the shots will clear the mask by moving the sight slide to the range, — gun to mask. If the line of sight clears the mask, the shots will clear it.

Accurate results will be obtained if the correct range is found, and the glasses are held about on the level of the gun.

If an aiming mark is not visible above the target, and the ground rises behind the gun, and the observer can see the target from a position a short distance in rear of the gun, an auxiliary aiming mark may be picked up on or near the crest of the mask and the auxiliary range found to the mark as above described.

Spirit Level Method: An ordinary spirit level may be used for this method. The controlling officer must be able to see the target from a position near the gun, preferably the rear of the gun, so as to line it in for direction. The gun and target must be approximately on the same level for the first burst of fire to strike the target. If the gun and target are not on the same level, the fire will strike somewhere near the target and corrections will have to be applied.

Having aligned the gun for direction, set sights at zero and level the gun with the spirit level, by placing the level on the gun and turning the elevating wheel until the bubble is central.

Place an aiming mark where sights are now pointing on near side of mask. Set the sight to the range to target and re-lay on aiming mark

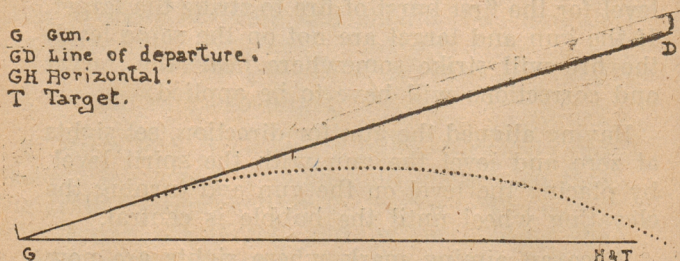
by turn of wheel. Insure that the shots will clear the mask. This method is valuable in flat country with dense low cover.

Aiming Post and Quadrant Elevations: This method is comparatively slow. It is valuable for training purposes, as exemplifying the principles underlying all methods of indirect fire.

It should be remembered that the range graduations of the rear sight are computed for gun and target on the horizontal. If the target is higher than the gun, we must increase our sight setting or aim above the target, and, if the target is below the gun, we must decrease our sight setting or aim below the target.

As the trajectory is a curve, we must elevate the bore to hit a distant target. The required degree of elevation to cause the trajectory to strike a distant target on the horizontal is regulated by the range graduations of the rear sight. This angle is called the angle of tangent elevation or *departure*.

The angle of departure (or angle of tangent elevation) — (taken from the range tables) — is the angle between the line of departure of the bullet and the line from the gun to the target.

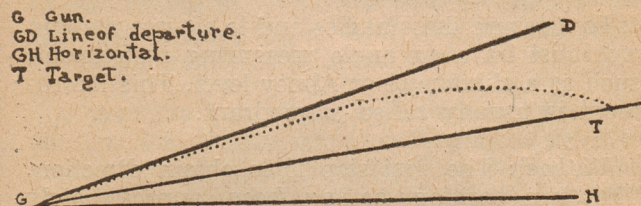


< DGT equals < DGH equals Quadrant Elevation
(Gun and target are at the same level, so the Angle of departure is equal to the quadrant elevation).

When the gun and target are not on the same level, find the difference in level between gun and target and the range. Convert these figures to degrees and minutes or mils to obtain the *angle of site*.

The angle of site (or angle of position) is the angle that the line from gun to target makes with the horizontal plane thru the gun. It may be either plus or minus, according as the target is above or below the gun.

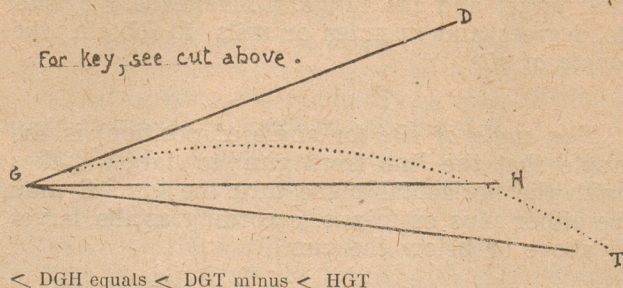
< DGH equals < DGT plus < TGH equals Quadrant elevation.



When there is a difference of level between gun and target, find the angle of site and if the target is higher than the gun, add the angle of departure; if the target is lower than the gun, subtract the angle of departure from the angle of site. The result is the degree of elevation or depression that will cause the trajectory to hit the target. This resulting angle is called the quadrant elevation.

The quadrant elevation is the angle between the line of departure of the bullet and the horizontal plane thru the gun. It is the sum of the angle of departure and the angle of site, when the target is above the level of the gun, and is

the difference of these angles when the target is below the level of the gun.



To measure these angles and to elevate the gun we must have an angle measuring instrument, such as a clinometer or Abney level. This instrument is usually called a quadrant.

Method: The first step is to obtain direction. The gun position having been approximately selected, two men advance with three aiming posts until the target is visible. Two aiming posts are then erected in the direction line or desired line of fire. If these two posts are not visible from the gun position, the third post is planted in accurate alignment with the first two.

If the target can be seen from a position in rear of the gun, considerable time is saved in planting the aiming posts, and a more accurate alignment is possible.

These aiming posts may be graduated to give range readings to the 1000 yard stadia of the telescopic sight (or to the mil scale of the EE glass) and the post to be placed nearest the gun should have a cross bar for traversing, and the bar may be graduated in inches, to read mils when placed 28 yards (1000 inches) in front of

the gun. This post near the gun will generally have to be placed slightly to one side of the line of fire and aim deflected on to it. The gun is placed exactly in line with the directing posts.

The next step is to obtain the correct elevation. While the aiming posts are being placed in position, the range takers obtain the range from the mask to the target, and then the range from the mask to the gun. For all practical purposes, the sum of these is the range.

If the aiming post on the mask is graduated to read ranges in 50 and 100 yard divisions to the stadia of the telescopic sight, the gunner reads the range from gun to mask.

A machine gun officer — observing officer — obtains the angles of elevation or depression from the mask to the target and to the gun position. These angles should be measured from the prone position.

From this data the angle of site is computed.

For example: From M (top of mask) take the angle in degrees (or mils) between M. T. and the horizontal (E) and between M. G. and the horizontal (E').

From M the angle to T is 1 degree, and the angle to G is -- 3 degrees. The range from M to T is 1000 yards, and from M to G is 400 yards. Total range is, therefore, 1400 yards approximately.

Formula to find angle of site:

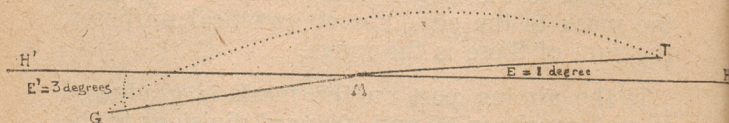
$$\frac{E \times MT - E' \times MG}{GT}$$

E = Angle from M to T in degrees.

E' = Angle from M to G in degrees. The angle of sight (gun to target) is :

$$\frac{1 \times 1000 - (-3 \times 400)}{1400} = \frac{1000 + 1200}{1400} = \frac{2200}{1400} =$$

$$1 \frac{4}{7} \text{ degrees} = 1^{\circ} 34'.$$



MT equals 1000 yds.

MG " 400 yds.

The angle of site is the angle which a line from G to T makes with the horizontal.

Angle of site $1^{\circ} 34'$.

From the « Table of Fire » (Handbook of the rifle No. 1923), we find the angle of departure for 1400 yards is 1 degree and 33 minutes. Add this to the angle of site for the quadrant elevation to be put on gun, which angle = 3 degrees 7 minutes.

The quadrant is set to read 3 degrees and 7 minutes, and is then placed on the gun, near the rear sight, and the gun elevated until the bubble is central, and is then clamped in position.

Note. — If the target is below the level of the gun, the angle of site is minus and we subtract it from the angle of departure.

The next step is to ascertain whether the trajectory will clear the mask. With the gun clamped, adjust the sight for range — gun to mask. If the line of sight clears the mask, so will the trajec-

tory. If it does not, the gun must be moved to the rear, or to higher ground.

Having determined « clearance », to maintain elevation and direction when firing, adjust the line of sight on an aiming mark — such as the lowest point of intersection of cross bar on the aiming post.

Alterations in Elevation. — As the sights are set to an auxiliary reading, alterations in elevation cannot be made in yards. Take a mil reading from point of strike to target and if the strike is short, order « up (2) mils », etc. The gunner elevates by turn of wheel 2 mils, then clamps his gun and moves his line of sight back to his original aiming mark.

Method by Compass and Quadrant (Data from Map):

Mark the exact position of gun and target on the map and find the compass bearing of target from gun position. (Position of gun may be found by resection.)

Next, find the range and then the difference in level between gun and target.

With the compass on or in rear of the gun position, lay off the required compass bearing to the target, and if no natural aiming mark is found on this bearing, place an aiming post or stake on this line. All iron equipment must be moved at least 25 yards from the compass, when taking a bearing.

The gun is now placed in position and laid on the auxiliary aiming mark, the direction being maintained by adjusting the slide of the sight to a suitable range and checking the alignment on the aiming mark.

Next find angle of site. In this case, as we obtain the difference in height between gun and target from the contours on the map, our formula to find the angle of site is simplified. The usual formula is :

$$\text{Angle of site} = \frac{\text{V. D. (in feet)} \times 19.1}{(\text{Range in Yards.})}$$

(or roughly 20),

in which V. D. is the vertical distance between gun and target. This gives us the angle of site in degrees.

A simple method of finding the angle of site in minutes, is to reduce the difference in height between the gun and target to inches, and divide the result by the hundredths of the range.

(A rise of one inch will occur on a one minute slope in 100 yards horizontal distance, or an angle of one minute subtends one inch in 100 yards).

Example 1. — If V. D. is 80 inches and the range is 1000 yards, the angle of site is 80
minutes. —=8
10

Example 2. — Target is 30 feet higher than the gun. Range is 2000 yards. Angle of site = $30 \times 12''$

————=18'. If the angle is plus, it is 20 added to the angle of departure to obtain the quadrant elevation to be put on the gun; if minus, it is subtracted. (Angles of departure are found in the Table of Fire.)

Set the quadrant to the required angle and elevate the gun accordingly. Clamp the gun and align the sight on the auxiliary aiming mark.

Ascertain if the shots will clear the mask.

The accuracy of this method depends greatly upon the accuracy of the map, the instruments used, and the experience of the personnel. This method may be greatly simplified, if traversing and elevating dials graduated in degrees and minutes or mils are put on the gun.

Method by Aiming Mark (Data obtained from Map) :

The method of indirect laying by compass and quadrant is slow, and is subject to inaccuracies, due to faulty adjustment of the instruments, lack of care of the personnel, etc.

A simpler and more accurate method of laying is to use the rear sight as an angle measuring device for the quadrant elevation, and the windage screw for setting off deflections in mils from target to aiming mark. We thus eliminate the compass and the level.

The application of this method requires a sight setting that will cause the bullets to strike the target when the line of sight is directed on the aiming mark.

The data are obtained from the map and the required sight setting for the aiming mark is quickly obtained by the machine gun slide rule.

From the map we obtain the range and the difference in level between the gun and target in feet, and, converting this distance to yards, we find the angle of site in mils by the M. G.

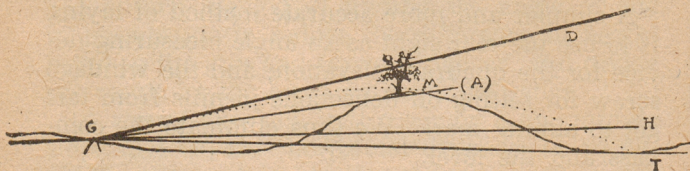
$$W \times 1000.$$

rule, $M = \frac{\quad}{R.}$

Having the range and the angle of site, the M. G. rule is again used to determine quadrant elevations.

As we are using an auxiliary aiming mark, we must obtain the vertical angle in mils between gun, target and aiming mark, and this is obtained by the same means used in finding the angle of site. This correction is added to the quadrant elevation, if the target is higher than the aiming mark, and is subtracted if the target is lower than the aiming mark.

The M. G. Rule is used to convert the resulting angle in mils to terms of rear sight elevations. The sight is then set to the range reading as found on the rule.



T Target.

G Gun.

M, (A) Mask. A hill with (A), a lone tree used as aiming mark. From the map we find;

Range GT 1375 yds.

Range GM 575 yds.

Elevation of G, 1012 ft.

Elevation of M, 1020 ft.

Elevation of T, 984 ft.

Then, from the M. G. Rule, we find;

< HGT, (angle of site) = 7 mils.

< MGH, = 4 mils.

Quadrant elevation = 1190 yds.

The vertical angular difference between the target and the aiming mark is 7 plus 4=11 mils. 1190 yards decreased by 11 mils gives 750 yards. This is the sight setting necessary to hit the target when aiming at (A).

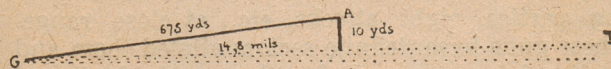
The horizontal angle, in mils, between gun, target and aiming mark, is converted to points of windage. One point of windage equals 1 1/6 mils. If the target lies to the gunner's right of aiming mark. « Right wind » is used, and « Left wind » if the target is to the left of the aiming mark.

Insure that the shots will clear the mask.

The gun is now laid on the selected aiming mark, and prepared for firing.

This method of laying is an embodiment of the principles of the inverted rear sight or graticule method, to be used when the data must be obtained from a map, or the target cannot be seen for obtaining graticule readings.

See
diagram
next
page.



Assuming that the tree (A), in the sketch above is located 10 yards to the left of the plane of fire ; then.

10 yards at 675 yards = 14.8 mils.

= 12 3/4 points.

Sight is set with right windage, 12 3/4 points.
(Exemples from S. of M. XIII.)

Night Firing :

In trench warfare, night firing emplacements are provided for machine guns. In these special emplacements, provision is made for bringing

machine gun fire to bear at night upon selected avenues of approach, such as roads, road crossings, bridges, fords, defiles, or obstacles in front of the position, such as wire entanglements, etc. Gaps made in the enemy's wire during bombardments, etc., must be kept open at night by machine gun fire.

Machine guns are laid in rear of the front line to employ long range searching fire upon the enemy's transport lines to hinder men and supplies being brought forward at night.

When the target is not illuminated, an auxiliary aiming device of some kind is used to lay the guns for firing at night upon selected targets.

When the target is illuminated, firing is conducted as in daylight.

The B. & L. range finder is used for obtaining ranges at night.

Machine guns, not laid on special targets, cover the immediate front and flanks to repel raiding parties, night attacks, etc., at close range. These guns have definite sectors allotted them and limits of traverse and elevation are laid off and marked by stakes.

The use of machine guns for night firing greatly reduces the number of riflemen required for duty in the front line trenches at night.

A « Very » pistol is provided for each night firing emplacement for illuminating selected targets. Machine gunners must be practiced in firing through Smoke Screens and Cloud Gas. Effort should be made to screen the flash of gun to prevent disclosing its position. A wet burlap curtain may be used for this purpose. Luminous material may be used for lighting up the front sight. As heat affects the luminosity of this ma-

terial, it is advisable to put it on a detachable clip which may be fastened to the sight.

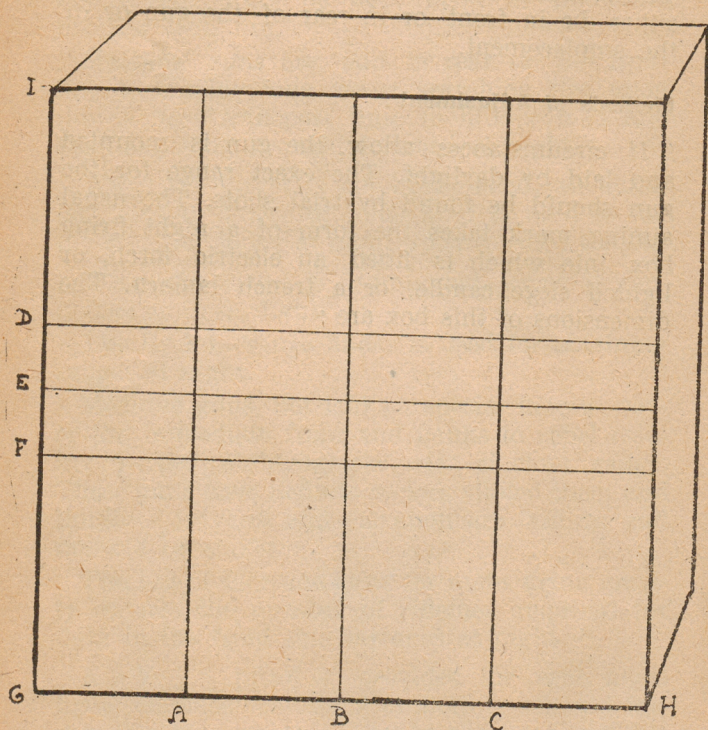
The glow from a lighted string will illuminate the cross of the telescopic sight.

When the target is not illuminated, auxiliary aiming marks are used. These aiming marks may either be in front or in rear of the gun or in the emplacement.

Methods of Adjustment :

If circumstances allow, the gun is mounted and laid by daylight. The exact range for the gun should be found by trial shots. The usual aiming mark takes the form of a night firing box into which is fitted an electric torch, or lighted siege candle, or a trench lantern. The dimensions of this box are :

Width G to H 10 inches.
 Height G to I 1/8 inches.
 A to B 2 1/2 inches.
 B to C 2 1/2 inches.
 D to E 1 inch
 E to F 1 inch



Distances between lines are measured from center to center. Lines are $\frac{1}{2}$ inch wide.

The horizontal and vertical lines are accurate guides to the firer when searching and traversing. Some searching is necessary at night to overcome errors in aiming and holding and faulty elevations.

It is also generally necessary to traverse at night and the amount will be controlled by the vertical lines. These lines are also used for setting off deflection, but when laying the gun by day, no allowance should be made for wind.

The first step is to place a stake 14 yards, or 500 inches, in front of the gun and in line with the target. A second stake is then placed in the ground in the gun position, and in accurate alignment with the target and the first stake. (A stake having a V shaped notch for the muzzle may be used.) Over this last stake, the gun will be set up after dark. (The stakes should not be over six inches above the ground.) At night, the central vertical line of the firing box will be placed against the first stake. The line of sight then brought to the intersection of the central lines.

By placing this box 14 yards in front of the pivoting point of the gun, the interval between the horizontal lines subtends an angle of 2 mils, and the interval between the vertical lines, 5 mils. In searching and traversing, these lines are used to regulate the overlapping of the cones of fire.

The horizontal lines being 1 inch apart, give us an angle of six minutes and fifty-two seconds between lines, or 13' 44" for vertical searching. For example :

If the target is 700 yards distant, the angle of departure is 26.104 minutes. For 800 yards, the

angle of departure is 32.441 minutes, a difference of 6.337 minutes.

If the range is 700 yards and the firer searches from the center to the top line, he will (on flat ground) search just beyond 800 yards, and if he searches to the bottom line he will decrease his elevation by 6' 52" or just under 600 yards. (See table of fire of the rifle.)

The vertical lines being each $2\frac{1}{2}$ inches from the central line, give a lateral traverse of 1 $\frac{1}{2}$ feet per hundred yards of the range. At 500 yards the traverse between the two outer vertical lines would cover 15 feet, and to the outer edge of the box 30 feet.

When the gun position is exposed, so that the gun cannot be laid during the day or when fire may be necessary from several different positions, a stake is placed in the ground 14 yards, or 500 inches, in front of the gun position and in line with the target. A second stake is placed in the ground in the position to be occupied by the gun and in line with the first stake and the target. Over this latter stake the gun will be set up after dark. If more than one target is to be engaged, other stakes are aligned between the targets and the stake marking the position of the gun. Ranges and angles of site are then taken to the different targets.

After dark, the gun and the night firing box are placed in position and the gun given its proper elevation by means of a clinometer, after which the gun is clamped in position and the line of sight brought to the intersection of the central horizontal and vertical lines of the night firing box.

Allowance for windage is made by using the vertical lines on the box. The interval between

vertical lines is, for all practical purposes, equivalent to 5 points of windage.

When a stake cannot be placed in front of the position during daylight, a stake is driven into the ground in the gun position and a stake in rear is placed in accurate alignment with it and the target to be engaged.

Before dark, take the range and angle of site, and the angle of departure (latter from range table), and find the quadrant elevation for the target. After dark, a stake 14 yards in front is lined up with the other two by means of a trench lantern.

The gun is given its proper elevation by means of a clinometer or other instrument measuring from the horizontal plane. The sights are aligned on the firing box, as in the previous case.

For methods of determining angles of site and quadrant elevations, see « Indirect Fire ».

A Night firing box.

T Target.

GH Horizontal thru gun.

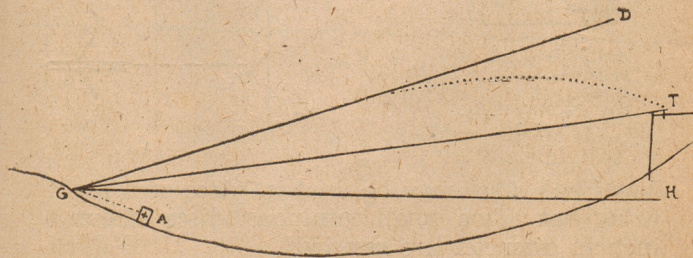
DGH Quadrant elevation.

< TGH Angle of site.

GD Line of departure.

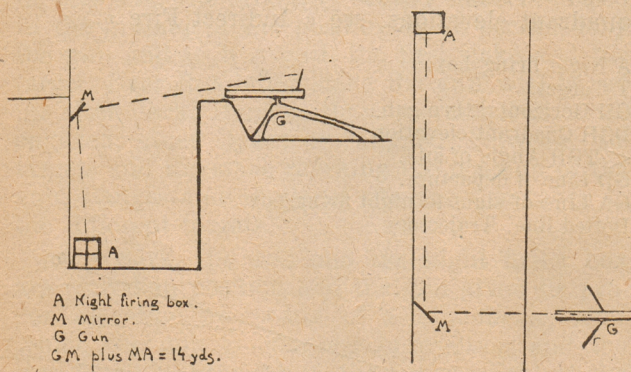
GA Line of sight to night firing box.

Dotted line. Trajectory.



When the gun can be mounted and laid by day behind the parapet of a trench (a periscope may be used if available) and the stake cannot be placed in front of the trench, the night firing box may be placed in the trench.

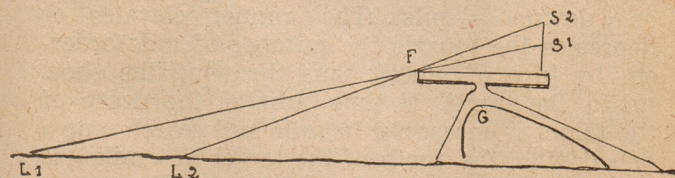
Method : The gun having been laid by daylight, place a mirror below parapet of trench and in line between gun and target. Place the night firing box in the bottom of the trench to the right or left of mirror, so that the total distance from the pivoting point of the gun to the firing box, through the mirror equals 14 yards. Move the mirror about till the firing box is reflected to the eye of the gunner at the sight. The gun is laid on the target and the auxiliary sight setting noted during daylight. The gunner uses the reflected night firing box as his aiming mark.



Luminous discs may be used in place of a night firing box. Two small luminous discs about 1 inch in diameter are required.

Method : Lay the gun by day on target with sights set at correct range, and clamp the gun in position. After dark, run the rear sight slide up to its highest position and get an assistant to place out in front of the gun a luminous disc and move it about till the sights are aligned on it. Then hold a live cartridge with point upon top of the rear sight and, sighting over the point of the cartridge and top of front sight, have assistant place second disc on ground in this line of sight. The disc farthest to the front is the aiming mark for night firing. The disc near the gun is for direction. If the discs can be placed in position during daylight, the gun can be mounted after dark. (These discs are also used for marking the limits of sectors.)

S 1 Rear sight.
S 2 Top of live cartridge.
L 1 and L 2, Luminous discs.
G Gun.
F Front sight.



Mirror and luminous disc. The gun is mounted during daylight and laid on the target. A mirror may be used from side of gun reflecting the disc placed in rear of the trench, or to the flank.

Moving Targets :

Perhaps the greatest characteristic of the machine gun is its ability to range on a moving target and to follow such target, as though its bullets were thrown by a hose, without alteration of the sights. No other fire-arm is capable of such power.

When the strike of the bullets can be observed, there is no difficulty in throwing the bullets on to the target by turn of wheel.

When the strike cannot be observed, ranges are found to objects ahead of the target. The guns are laid on such objects and fire opened as the target approaches the object and traversing or searching used to cover the target with fire.

If but one gun is available, an estimate is made to an object ahead of the target and fire opened as the target nears the object. If the target is a lineal one, such as a column of four, and is moving from or toward the gun, the bullets may be thrown on to the target by turn of wheel, or the observer may measure the angular distance short or over in mils and direct « up » or « down » (—mils). The gunner elevates or depresses the muzzle the number of mils ordered, by turn of wheel, thus throwing the shots on to the target. If time admits, the depth of the target is measured in mils and search « up » or « down » the depth of the target in « mils » is ordered as the shots strike the head of the target.

Strike target at its head and check its movement by searching « up » if it is coming towards you, or « down » if moving away from you.

As a moving target will soon escape unless covered with fire, two or more guns should be

used, if available, and the target hit at its head and tail and searched through its depth and breadth.

Lineal targets, such as a column of fours, *crossing* your front.

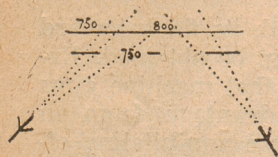
As this target is moving with its flank toward your guns, surprise effect must be obtained. Experiments have demonstrated that machine guns can engage lines to greater advantage from an oblique direction and can obtain annihilating effect when on a flank. At 45° an increase of 30 % can be expected. With four guns available, the two flank guns should employ oblique or cross fire on the head and tail of the target, traversing inward ; and the fire of the two center guns should be directed upon the half of the target in the immediate front of these guns, the fire overlapping near the center of the target. Fire for effect should be opened at once. As this target is crossing your front, there is but slight change in range, excepting for the guns employing cross fire. All changes in range are made by turn of wheel.

A linear target moving from or toward your position : —

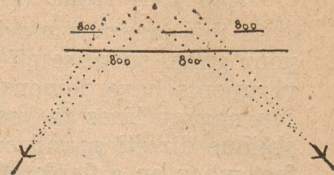
If this target remained stationary, it would be more difficult to hit than if moving. If stationary, and cross fire is employed, say from 750 yards, on the flank nearest the gun ; as the gun traverses towards the center of the target, the gunner must elevate as well as traverse.

If the target is moving on the position, and fire is opened on the flank nearest the gun, and the gun traverses inward, there is practically no change in elevation during the period the target will remain exposed. Cross fire « traversing inward » produces converging cones of fire, with

greater moral and material effect. If the target is moving away from the position, cross fire should be opened on the interior of the target and « outward traverse employed ».



Targets moving toward position. Cross fire. Inward traversing. Practically no change in range while target is exposed.



Targets moving away from position. Cross fire. Outward traversing. Practically no change in range, while target is exposed.

Inward traversing, when employed with cross fire, may continue until the sheaves cross between the target and the gun position. It then becomes *outward traversing*. This rule applies to outward traversing — reversing the terms.

The advantage of the method lies in the fact that there need be no suspension of fire for the purpose of correcting sight settings or adjusting elevations.

If the guns are not in position to employ cross fire, the target is divided into sectors according to the number of guns required. With four guns, use four different points of aim.

If working by platoons, the target is automatically divided into two parts. Each gun covers its own sector and overlaps into adjacent sectors. If one gun has a stoppage, the other gun of that platoon covers the entire platoon target. With this system there is no delay in the division of the target into sectors. Traversing is first from the flanks toward the center. Swinging

traverse is used. For trench warfare and against dense targets at close range, the swinging traverse has been found necessary.

Different points of aim assist observation. Fire is distributed and the target hit in several places with the same total volume of fire.

Combined sights may be employed. The following method is considered more effective. Set sights to range on an object in path of the target and open fire with all guns used. Observe effect and throw shots on to target by turn of wheel. The reasons for this method are: The target is moving and surprise effect must be obtained and fire for effect opened without delay, or the target will disappear. No two machine gun barrels require the same sight setting for the same range and absolute reliance cannot be placed on the range finder. The sight setting required for each barrel at each range is seldom at hand. The target is moving and will not wait for us to issue a combined sight order. We get the effect of combined sights.

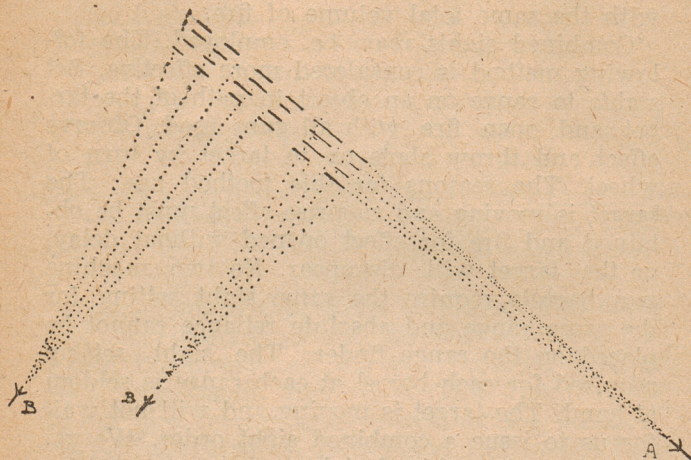
Targets moving in an oblique direction :

Machine guns properly posted are echeloned in depth and arranged for cross and flanking fire. If provision for frontal fire only is made, then targets moving in an oblique direction become difficult to hit or to keep under fire.

Cross fire on the contrary, creates an overlapping of cones of fire and produces both enfilade and flanking effects, with consequent moral and material results.

Guns posted to fire practically parallel to the march of the target obtain enfilade effects on the head of the target, followed by searching (a).

Guns posted perpendicular to the line of march of the target (b) should create a dense sheaf through which the target cannot pass, followed by distributed fire, « inward traversing ».



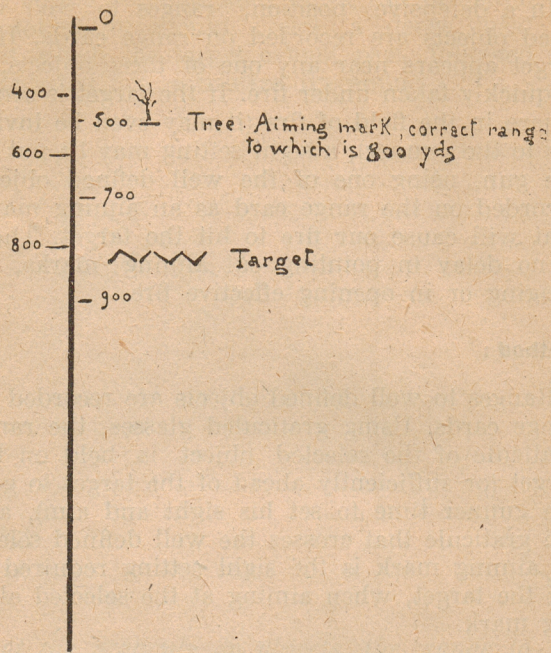
Use of the graticule on objects the range to which is known, for quickly finding the sight setting that will cause our fire to strike a target.

Moving targets generally appear suddenly and disappear without loss of time when fired upon. Such targets are often invisible to the gunners. Opportunities are often lost by time taken to point out the target, to select points of aim and to range by finder or gun. To hit the target is the first consideration; after that, the machine gunner follows his target either by observation of the effects of his fire on a live target, or by selecting additional points of aim ahead of the target.

In a defensive position, ranges to well defined objects are recorded on range cards. If a target appears near any one of these objects, it is quickly taken under fire. If the target is somewhere in the field of fire (it may even be invisible to the gunner), a sight setting may be put on the gun, using one of the well defined objects recorded on the range card as an aiming mark, that will cause our fire to hit the target. There is no delay in pointing out aiming marks, in ranging or in opening effective fire.

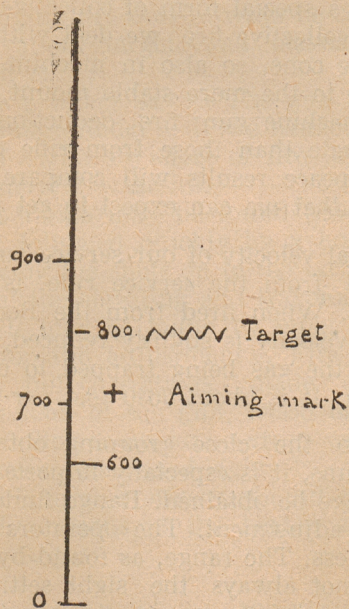
Method :

Ranges to well defined objects are recorded on range cards. Using graticuled glasses, the range graticule of the selected object is held on the target (or sufficiently ahead of the target to give the gunner time to set his sight and aim), and the graticule that crosses the well defined selected aiming mark is the sight setting required to hit the target, when aiming at the selected aiming mark.



In the diagram, the recorded range to the base of the tree is 800 yards. Using the base of the tree as the aiming mark, the graticule corresponding to its range, 800 yards, is held on the target or slightly ahead of it, and the range graticule, 500, that crosses the base of the tree is the sight setting required.

For targets moving from or toward one of the recorded objects, changes in sight elevations may be obtained without moving the glasses to keep the range graticule of the recorded object on the target. Invert the scale, zero at bottom, and hold the graticule of the aiming mark on the mark,



and use the graticule that crosses the target as the sight setting for the target while aiming at mark.

This does not give the range in yards to the target; it gives the vertical angular difference in elevation between aiming mark and target, in terms of the sight or the elevation of the bore that will cause the trajectory to hit the target.

MANAGEMENT OF FIRE :

Direct Fire :

The theory of rifle fire applies to the machine gun, but requires modification in detail to suit the characteristics of the machine gun. Machine gun fire is a special form of collective fire, and, as in rifle collective fire, we deal with the positions of the cone, so also in machine gun fire ; but, owing to the more stable mount, we know that our machine gun fire deductions will be more accurate than those from rifle cones, and that our peace results will compare favorably with those that we can expect to get in war.

The initial velocity of our service ammunition, when fired from the service rifle, is 2700 feet per second. When fired from the Benot-Mercie, the initial velocity is slightly reduced, due to a portion of the gas being trapped to operate the mechanism. It is about 2640 feet per second.

Owing to the close grouping obtained with machine guns, it is especially important that the correct range be obtained. Range finders are not always in adjustment. The operators are sometimes careless. The range, as found by the range finder, is not always the sight setting to use. Wind, barometric pressure, etc., must needs be considered. If the range, as found by the range finder, is not correct, we must resort to ranging fire. It is infrequent that two machine gun barrels require the same sight setting for the same range.

Where we can get observation of strike, we can rely upon getting the correct sight setting quickly and accurately, but, before using rang-

ing fire, we must consider the factors of the disclosure of our fire position, and the loss of surprise effect.

The machine gun is peculiarly adapted to getting the range to a moving target, and, once having adjusted on it, to follow uninterruptedly. No other weapon can do this.

Ranging fire must always be considered, when observation, target, and tactical considerations permit it.

The artillery say : « The gun is, after all, the best range finder ». If we cannot get observation of the strike or effect of fire, machine gun fire is generally wasteful.

The range may be found quickly by an estimate, followed quickly by a burst of fire, then throwing the shots on to the target by manipulation of the elevating and traversing device of the gun. It may be found by what is known as an « Automatic adjustment ». Fire may be adjusted by mil corrections, made on the control mechanism of the gun, based on observation of strike. Slower processes are — vertical searching, bracketing combined sights.

Machine gun officers should be familiar with the dimensions of the beaten zones at the various ranges.

Lateral Distribution : (« Distributed Fire ». « Traversed Fire »).

Fire is distributed along a line, a number of different aiming points being used. These points must be close enough together to insure that the target will be covered with fire.

This is the normal method of traversing, but when time is an important factor (as in repelling rushes or sweeping a parapet), the « Swing Tra-

verse » is used. In this method, the gun is swung in azimuth while firing.

Distribution in Depth (« Searching Fire ». « Vertical Searching ». « Zone Fire »).

This class of fire is used in ranging to cover a deep area, or to cover a deep target.

Economy of guns to cover a target, either in depth or width, is based on, — the beaten zones at the range, the nature of the target, whether or not it is moving. If the target will not wait for us to make the usual calculations, the safe rule will be to make sure to cover it with fire, even if every available gun has to be used.

Methods of Control :

In open warfare, the control of the guns is in the hands of platoon commanders. In trench warfare, the guns are assigned to sectors, and are under the control of machine gun commander of the sector. The machine gun officer stations himself where messages can most easily reach him. He keeps in touch with his guns, and with the officers of the lines of trenches which he is assigned to help defend. He arranges for fire control. Usually, in the trenches, one man is placed in charge of each gun, with detailed instructions for various circumstances. The position of the gun commander must be known to all. Every machine gun man must know the location of every gun in his sector, whether it is in the front line, the support trenches, in reserve or in position in rear, and the best route by which to reach it.

Time Tables and Barrage :

The timing of the barrage is fixed as part of the corps artillery plan, by the corps commander, after consultation with the division commanders, particular attention being paid to the points of junction between divisions, to insure that the barrages on the divisional fronts will overlap properly. The timings are then issued to all concerned.

The arrangements for the barrage for the whole corps front may be coordinated by the corps machine gun officer, but the *control* on each divisional front must be entirely in the hands of the divisional commander, immediately the attack starts. The lifts of the barrage must be carefully worked out, to synchronize with the artillery barrage, and, where indirect fire is being used, the machine gun barrage must be kept at least 400 yards ahead of the advancing infantry.

When the objective is reached, the machine gun barrage conforms to the operation of the artillery barrage, as regards ceasing and opening fire ; it should usually be employed to barrage covered lines of approach, and places where the enemy might assemble for the counter attack.

Sixty rounds per minute per gun has been found to be a satisfactory average rate of fire for a *sustained* barrage. The secret of a successful assault is exact conformity of the infantry to the timing of the barrage. Success depends upon their being within 50 yards of the artillery barrage when it lifts from the hostile front line trenches.

Fixed Fire :

Is used to cover fixed objectives, such as road junctions, bridges, dead spaces : to keep open gaps in entanglements, night firing, on defiles, etc.

Flanking Effects :

The fire of a machine gun produces a sheaf, dense, deep, but narrow. The increase of the width in distributed fire gives to the sheaf a greater breadth but the density becomes insufficient to produce much effect. The fire of a machine gun will have its maximum effectiveness against an objective of narrow front and great depth. *The closer the guns can approach a linear target, the more oblique becomes their fire.*

In the attack, machine guns are allotted to prevent cross fire from rifles and machine guns located in enemy trenches on the flanks of the attack ; others are allotted to bring flank and enfilade fire to bear on portions of the trenches selected for attack. When the attacking infantry masks the fire of the covering machine guns, these guns should, if possible, direct their fire past the flanks of the attacking troops, so as to keep down hostile flanking fire and prevent flanking offensive returns. Due to the facility with which machine guns can change the direction of their fire, they form the best protection for the flanks.

On the defensive, the employment of machine guns for flanking fire is still more necessary. The object to be attained is the installation of

the guns in positions such that, if the hostile troops penetrate our first line, their further advance will come under the flanking fire of the successive echelons of guns. It is a matter, not of sweeping a wide sector, but of developing, over certain strips of ground, flanking fire, which will surely cut down the successive waves of the hostile advance. The rule is to echelon the guns, and to seek to employ them always in flanking fire.

Division of Guns :

Machine guns are divided into *machine guns proper*, such as the Vickers, and *automatic rifles*, of which the Lewis and Benet are types. The automatics are assigned to infantry companies, and the machine guns to M. G. companies.

The machine gun provides cover for attacking infantry ; covers the withdrawal of infantry in case of failure of the attack ; fills gaps which may occur in an attacking line, assists in the consolidation of the positions taken, and in repelling counter attacks. It is employed for indirect fire, night fire, barrage work, etc. Its principal role is *defensive*.

The role of the automatic rifle is mainly *offensive*. It is used before, during, and after the assault. They are now an integral part of infantry companies. They should be used with boldness and cleverness, especially in knocking out enemy machine guns. They are used after the assault for the outpost line, to back up patrols exploiting success, and to garrison the line which is being consolidated.

The assignment of guns is based on the number of each type available, in accordance with the length and importance of the sector.

Replacement of Damaged Guns :

Each brigade has a machine gun depot, where spare guns and parts, pack outfits, etc., are kept on hand. Damaged guns are repaired in the organization, if possible. It is essential that each member of a machine gun organization be familiar with the mechanism of the gun, and be able to make repairs. It is a point of honor with a machine gun man to always have his gun tuned up and ready for any emergency. Machine gunners should be trained in the mechanism of enemy guns, and how to operate and how to disable them.

Methods of Observation :

A sentinel is on duty in each emplacement in use. Men are trained in the use of the field glass and periscope. Selected men are trained to observe the effects of fire, and to be able to announce corrections. This is highly important in overhead fire, indirect fire, and in barrage work. Smoke bombs and cloud gas are used to blind machine guns likely to cause trouble by flank fire, etc., therefore, machine gunners must be trained to note carefully the targets assigned to their guns, and have practice in firing through smoke screens and cloud gas.

Each machine gun has a « Very » pistol to illuminate night targets.

Contact patrol airplanes are assigned to the infantry for *observation*.

Division of Gun Crews Into Reliefs :

Detachments are relieved systematically. Three or four men are in the position at one time, the remainder being in reserve at central dugout or ammunition station. This arrangement will enable the front line men to be relieved every 24 hours. Units should be relieved every few days.

When relieving another gun team or sentinel, ascertain :

If fired, what was the target ?

If fired, from what emplacement ?

It is important that a portion of the personnel be kept out of the fight, both for the purpose of replacing casualties, and relieving the men in action. This is especially necessary in the case of guns detailed for barrage work, as the nervous strain of maintaining fire for a long period tells very heavily on the personnel. Men from the infantry may be detailed to assist in carrying ammunition boxes, etc.

The following number represents the minimum which should be left behind on each occasion when the unit takes part in a fight ; each company, either the commander or the second in command, and about 33 % of machine gun men.

Particular care should be taken to see that the out-post line is taken over correctly ; as a rule, outgoing units should leave their *machine guns, automatic rifles, snipers, and scouts* in the line for 24 hours after relief, in order that the incoming unit may be able to establish itself properly.

All officers should be fully conversant with all of the duties of their command. To provide reliefs, they should rotate in their duties.

AMMUNITION SUPPLY :

The amount of ammunition which must be immediately available for each gun at all times, must be the amount required for firing continuously through a crisis. This is fixed by the mechanical limitations of the weapon in use, and the tactical requirements. For the automatic rifles this would require 3000 rounds, and for the machine gun, 6000 rounds. Hence, there should be with the guns these amounts ready for use. The ammunition on the combat wagon (about 600 per gun) will be unloaded at battalion dumps, and will be in original packages. Ammunition from the divisional train (about 10,000 per gun) will be brought to this point by the combat wagons as soon as they can refill. Prior to reaching the point at which it becomes necessary to transport the ammunition by hand, it is carried on the pack or vehicle with which the organization is equipped, and in the divisional trains. Up to this time, the supply is a matter of divisional orders. Upon reaching a point beyond which such transportation cannot proceed, it becomes the duty of the machine gun commander to provide for transport by hand, or other inconspicuous means

The subject of the supply of ammunition for machine guns and automatic rifles during an engagement, must be carefully planned in advance, and involves consideration of :

The amount required from time to time.
Distance to be transported.
Character of the ground to be crossed.
Number of men required.
Method of transporting.

The ammunition from the combat trains is transported from the battalion dumps to loading stations, established near the guns, and moved forward as soon as possible after the guns. The ammunition from the divisional train, when needed, will be handled in the same way.

The ammunition may be taken by cart, sled, pack animal, or by hand. Fire may force men to crawl and drag the ammunition. This method would be facilitated by the use of a small cart or sled. Original boxes may be broken, and the bandoliers slung about five on a man, or the bandoliers can be thrown forward from man to man of a chain. The distance, character of the terrain, and the necessity for concealment, will determine the number of men and means required.

It has been computed that, to carry the necessary equipment and the ammunition required for immediate use, it will require, for the automatic rifle, seven men, and for the machine gun, nineteen.

The supply of ammunition is divided into three phases :

1. Moving forward (with the guns) the reloading apparatus and the ammunition needed for immediate use.

2. Moving forward the reserve supply to reloading stations near the guns.

3. Loading the reserve ammunition into belts, strips, or magazines, and supplying these to the guns.

The carrying out of the first phase is the duty of the organization commander going forward,

utilizing all of the available men of his unit. The carrying out of the second phase is the duty of an officer designated by the commanding officer of the troops to which the machine gun unit is attached after consultation with the company commander. This officer is authorized to utilize men of the supports and other men going forward, to deliver ammunition to the reloading stations. The carrying out of the third phase is the duty of the machine gun unit commander, utilizing men not actually required for duty with the guns.

The problem of supplying ammunition to guns in a defensive position should be carried out along the general lines as prescribed above. Unit commanders should cause the men of their units to carry as much ammunition as practicable when they move to their stations. Additional ammunition should be sent forward to them from time to time as needed. This should be carried by parties detailed for that purpose.

The loading stations should be established near the guns. Spare belts, strips, or magazines should be supplied to these stations. Reserve gunners are held here. The store of ammunition available for use by reloading stations, is placed in shelters, dry and clean to prevent deterioration, and separated into small lots to prevent total loss during bombardment. Ammunition which has been loaded into belts, strips, or magazines, should be minutely inspected once daily.

A SYNOPSIS OF THE PRINCIPLES OF THE TACTICAL EMPLOYMENT OF MACHINE GUNS IN TRENCH WARFARE

The Attack :

Machine guns during the advance to the attack, from the commencement of hostile artillery fire to the occupation of the first effective machine gun position.

Object : To get to fire positions from which effective fire can be opened.

Essentials of these positions :

Field of fire (command, view for observation).

Cover (from view — defilade — from aerial reconnaissance).

That fire from them be not masked by our own troops.

Method : Conform to the movements of the attacking troops. This calls for intimate communication between each machine gun officer and the commander of the unit with which he is cooperating. Get the complete equipment as far forward as possible. Weights are reduced in accordance with necessity. Advance as far as possible with the maximum of ammunition.

Value of your fire will be much increased by :
Being in the nature of a surprise.

Being opened simultaneously from several positions.

Being from oblique directions.

Being crossed.

The Waiting Period of the Attack :

Select positions for single guns in echelon and not less than thirty yards apart. Prepare positions in readiness for the guns and crews (essen-

tial is shelter. Reconnoiter to the front and flanks for alternative positions and approaches thereto. Prepare three sets of range cards :

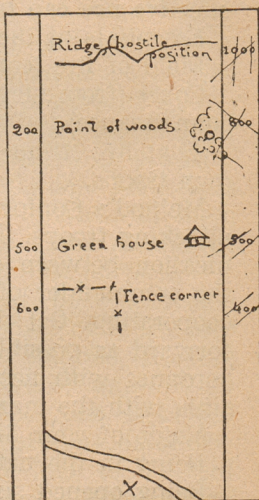
1. From waiting positions.
2. From selected advance positions (done by scout details).
3. For advance (reverse card method).

Radial cards (1 and 2) remain at all times in the positions to which they pertain.

Targets	RN	ASi	AS	CB	DF
1 House					
2 Hill					
3 Windmill					
4					
5					
6					
7					
8					

Position
 H^g, date
 Name
 Rank, etc

RN Range
 ASi Angle of site, degrees
 AS Angle of site, mils
 CB Compass bearing
 DF Deflection



Both cards should have a magnetic orienting line, if possible, and an orienting line to a prominent landmark.

Hold fire in reserve, but do not neglect opportunities for fire on large, vulnerable, or otherwise especially suitable machine gun targets. If put into action prematurely, loss is risked, am-

munition depleted, and full fire power of guns may not be available when most needed.

Prepare data for overheard and indirect fire—inform troops if they are to be fired over.

If position is to be occupied over night, load and lay guns for night firing. Augment the ammunition, and assure a continued supply. All machine gun units and ammunition stations must be mutually informed of locations, and of routes of communication and supply. Lay lines of information to posts of higher commanders. The system of information will be elaborated as far as time and opportunity permit.

Use of Cover During the Advance and Attack :

One of the first principles in the tactical employment of machine guns is concealment of guns. In the advance, every opportunity must be taken to shield the guns from the view and fire of the enemy. The necessity for cover in the attack begins with the advance under artillery fire, and, as the machine gun unit is on the same status as the attacking infantry, it will take the same general measures for protection as are taken by the infantry. By adopting the formations of, and mingling with the attacking troops, machine gun units may often conceal their identity.

Cover from view may often be found in woods, behind brush, logs, or in trees. Cover from view and fire may be found in ditches, shell holes, accidents of the ground, etc.

Above all, avoid passing close to prominent objects or landmarks.

In attack, light intrenching tools should be carried by members of the gun squads. Sand-

bags should be carried forward. The best protection is to overwhelm the enemy with fire, When you halt, dig in. These emplacements must be as inconspicuous as possible, with especial reference to aerial reconnaissance. In order to prevent the destruction of more than one gun by a single shell, they must be spaced and echeloned suitably. An ammunition box placed as a rest, with two boxes placed on edge separated sufficiently to allow the gun to be placed between them, forms a good embrasure. [A rolling cylinder made of loose hemp, of sufficient diameter to resist small arms fire was used successfully in the Philippines to advance troops (flying sap.)]

In the final stages of the attack, while concealment and defilade are desirable, fire power is the first consideration. Gun commanders will seek to obtain such protection as is consistent with the development of the maximum fire power.

Machine Guns of the Attack During the Assault :

1. Open with full fire power on portions of enemy lines selected for assault.
2. Overwhelm defenders so they will be unable to prevent the launching of the assault.
3. Keep concealed as much as possible for protection, and endeavor to make each opening of fire a surprise.
4. Have enough ammunition and personnel available at all times for supporting the assault and resisting offensive returns, or covering withdrawal. Gun crews must be divided so that a reserve of personnel is available to replace casualties. This reserve of men is available for ammunition supply.

5. Retain a portion of the guns in hand.

Paragraphs 1 and 2 above require a knowledge of the progress of the advance and positions selected for assault. This is accomplished through intimate communication with the commander of the assaulting troops.

Paragraph 3 above involves a study of the routes of advance, the successive firing positions, and the time for opening fire.

Paragraph 4 above involves methods of communication and the organization of the supply of ammunition and reserve gunners. The general supply of ammunition devolves upon the commander of the unit to which the guns are attached. Battalion commanders, if guns are attached, should arrange this with their battalion supply. Machine gun companies, acting as such, maintain their own supply.

The machine gun commander must retain the immediate control of a portion of his guns.

In general, guns may be employed for a concentrated fire upon points in the defensive lines. If disposed on the flanks of an attacking force, they are ready for instant action.

The attacking guns, having reached a favorable position and opened an effective fire, should not be further advanced until the assault has closed. When their overhead fire becomes dangerous to assaulting troops, the fire should not cease, but the sheaf should be lifted.

Machine Guns of the Attack in the Period Following the Assault :

Case 1. Successful Assault.

Object : To secure the captured ground.

The guns should assist in the consolidation of the position gained and repel counter-attacks, both local and general. This is the first *consideration*.

Establish several successive barriers of fire, with guns echeloned in depth for flanking and cross fire.

Divide guns between front lines and terrain in rear, organizing fire emplacements. Move supporting guns forward as rapidly as possible. Replenish ammunition, tools, food, water. Construct strong points and machine gun nests in rear of the new line.

Case 2. Unsuccessful assault.

Object: To minimize the loss to our foot troops, and to reduce the value, to the defenders, of their local success.

The guns seek cover, and shield, by fire, the withdrawal of the attackers. *This is the first consideration*. If necessary, guns must be sacrificed.

The flanks should be protected by echeloning guns. Guns in rear use overhead and indirect methods for covering fire.

In general, each element of the attack, whether successful or not, will so engage the enemy in its front, as to prevent a deflection of his fire to the flanks of our adjoining troops.

Reserve Guns of the Attack During the Assault and Immediately Following :

Object: To provide a reserve of fire power, held under the orders of the sector commander, to be utilized as the situation may demand.

Brigade reserve guns, i. e., those guns not allotted to the assaulting battalions, are held as a real reserve under the orders of the brigade

commander, so that he can apply their fire where it is required as the attack progresses. Part or all of them may be moved forward.

1. To support attacking troops which have been halted.

2. To close gaps of the attacking formation.

3. To assist in the expansion of captured ground.

4. To protect withdrawing troops.

The forward movement of the reserve guns is usually along concealed routes in rear of the flanks. Emplacements should be prepared for the reserve guns, and positions selected along the routes to the front. Range cards should be made.

During the early stages of the consolidation of captured ground, the machine gun officers will arrange for the replacement of casualties from their company reserves. Communication will be restored and improved.

The Defense :

The Machine Gun in Defense from the Opening of the Infantry Fire Attack, Until the Hostile Infantry Reaches the Assaulting Point :

Objects: 1. To insure that the assault will fail if delivered.

2. To destroy the attacking force before it reaches the assaulting point.

(This requires an effective fire at all ranges, maintaining a reserve of fire sufficient to overwhelm the attack at the moment of assault.)

These objects are accomplished by arranging emplacements for guns in different zones of the position in, in front of, and in rear of the first

line to bring cross, enfilade and frontal fire to bear upon the attackers.

Guns of the Defense From the Commencement of the Assault :

Object : To destroy the assaulting troops.

The guns of the defense are generally placed in platoons, but may be placed singly. The organization of the position should have insured that there is no favorable place available to the attackers for the organization of the assault. Some of the guns must be placed so that they can fire in a wide angle to the front, without being masked.

The assaulting troops should be overwhelmed with fire from the moment the assault is launched. This is best accomplished by flanking and cross fire. Machine guns to be able to bring such fire to bear, must be placed well to the front.

To escape destruction by bombardment, it is essential :

(a) That they be kept under sufficient shelter (bomb proofs).

(b) That their emplacement be invisible (alternative emplacements necessary).

(c) That they be echeloned in depth.

The emplacements must be close to the underground shelters, and connected therewith by underground passages.

Machine gun units must be willing to sacrifice their guns, if they can inflict a commensurate loss on the attackers. In many cases, the tenacity and heroism of a few machine gunners have

made possible the quick and easy re-capture of a lost position.

To increase the power of resistance, particularly in the supporting lines, machine gun positions should be :

(a) Provided with solid cover.

(b) Surrounded by low wire entanglements.

(c) Have several emplacements of fire in the same site.

(d) Provided with all possible means of protection against gas, and have abundance of food, ammunition and water.

Machine Guns of the Defense in the Period Following the Assault :

In case the assault is unsuccessful, all possible fire is brought to bear on retreating troops and on their supports and reserves, with a view to inflicting the maximum of losses, and preventing a reorganization of the attack.

Neighboring defenders should be assisted by flank fire brought to bear on troops in neighboring attacks. If these have penetrated the position, our guns should take part in their isolation, with a view to the prevention of consolidation of the captured ground.

In case the assault is successful, advanced machine gun positions must be held until the last possible moment, guns being disabled before loss. Machine gun positions of the supporting lines should be held at all hazards. Their duties are, to cover the withdrawal of other troops, to isolate the attacking troops in the front line, and to lend their support to counter-attacks.

Counter-Attack on Positions Which We Have Lost :

Object : To destroy the hostile force before they can organize the position.

It is essential to the success of an immediate counter-attack, that it be supported by the most powerful machine gun fire that can be brought to bear.

Guns in our old support lines, which have escaped destruction, will maintain a heavy fire in order to prevent the extension and consolidation of the position.

Guns further back, and especially guns which can bring to bear a flanking and cross fire, will afford their support to the counter-attack.

Reserve guns of this sector and guns from the reserve, which have been sent to the assistance of this sector, should maintain a curtain of fire on the ground in the enemy's rear, for the purpose of isolating him.

The best chance for success lies in the original organization of the position in such a way that there will be guns available for the support of the counter-attack, and that these guns are well protected and well served.

If early success cannot be achieved, the enemy is permitted to more or less completely consolidate his ground. Its re-capture then is dependent upon the success of a deliberate attack, which must follow the general principles laid down for such a maneuver.

Use of Cover in the Defense :

When a position is deliberately prepared, the machine gun positions are selected first. This enables the position to be held with the mini-

mum number of riflemen. The organization of a position is based upon the following principles :

The establishment of a non-continuous firing line.

The placing of all lines to combine against front and flank firing.

Firing positions sited with a view to lateral cross fire and flanking fire.

Emplacements for machine guns should be so disposed as to provide, along the front, several successive fire barriers. These emplacements must necessarily be echeloned in the direction of depth. (This arrangement of emplacements has many other advantages.)

Several firing emplacements must be provided for each gun.

Strong points should be constructed in, and in rear of, the supporting lines.

The protection of the emplacements during bombardment necessitates that they be constructed with solid cover and be invisible.

The position and the foreground should be divided into sectors, and sometimes, into sub-sectors.

Arrangements should be perfected for supporting a counter-attack in case of the loss of any part of the position.

Deep shelter must be provided for the personnel.

The fire of a machine gun has its maximum power upon an objective of narrow front and considerable depth. As infantry fights in thin lines, the fire of the machine guns will have its greatest effect when delivered from a flank. Successive barriers of fire, parallel, or nearly parallel to the front, afford a ready means of delivering this flanking fire. The echeloning of emplacements, with this in view, will permit of

firing in almost any direction. These emplacements should be under solid cover. Several emplacements should be provided for each gun — one to be reserved as a *battle emplacement* — never used except in resisting an attack.

All emplacements should be concealed from aerial reconnaissance, and may be protected against artillery bombardment.

To obtain the widest possible traverse, emplacements intended for frontal fire should be open to the sky. All emplacements should be surrounded by low wire entanglements of irregular trace, and as invisible as possible.

Each emplacement should be numbered and marked, and provided with an order board (orders for sentinel and gun commander) and range card. Numbers are from right to left in each brigade sector.

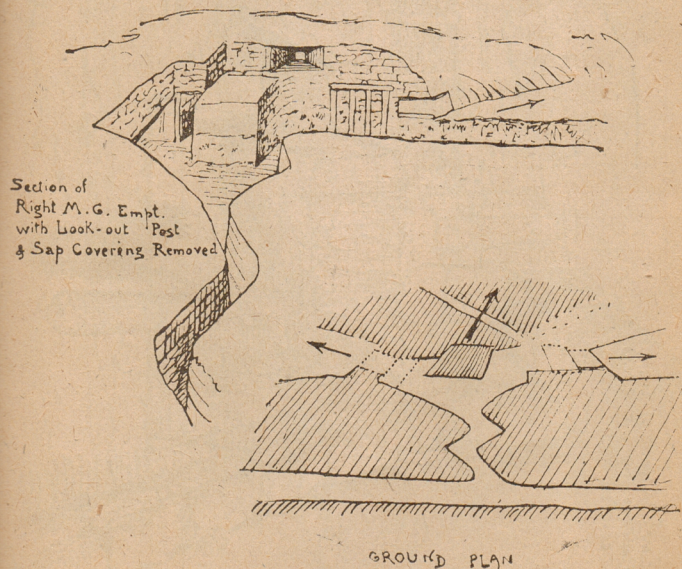
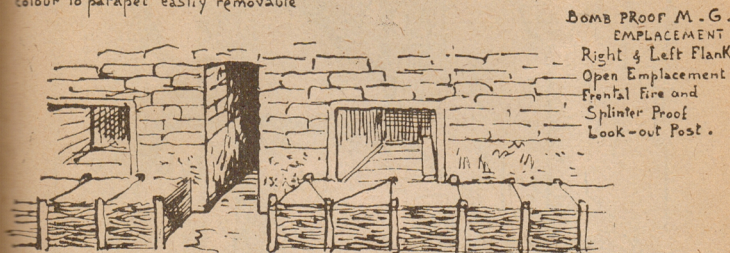
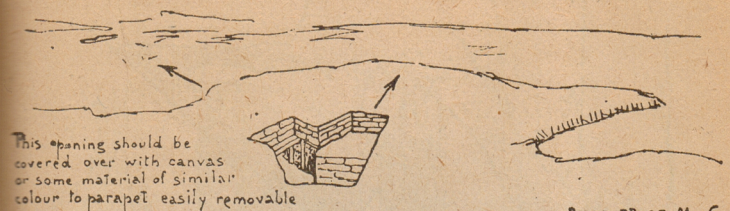
Dummy emplacements are useful. Occasional firing should be done from them.

Limits should be marked in, or in front of, each emplacement, to which each gun may be traversed, without danger to friendly troops.

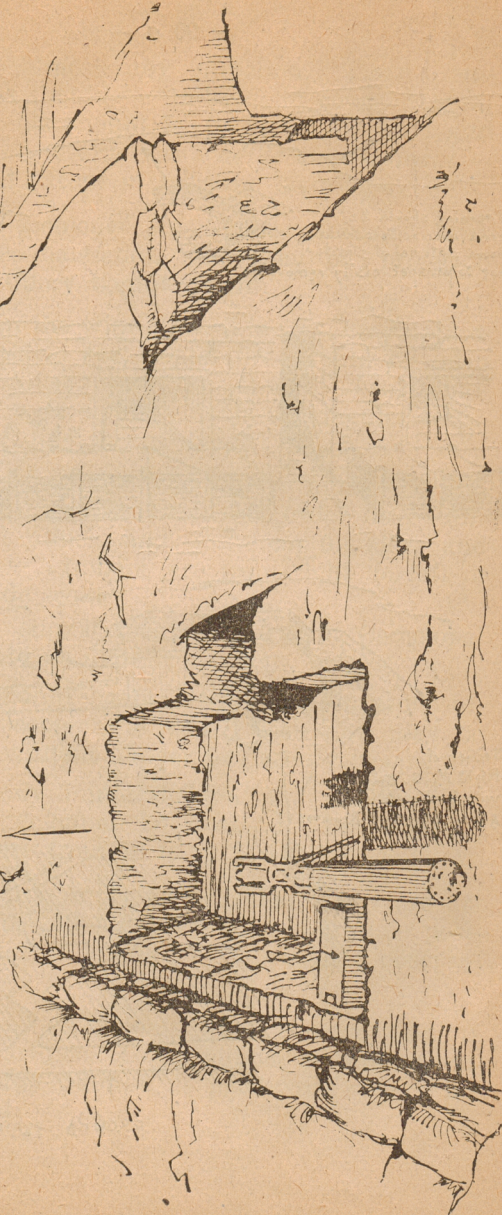
It is highly important that the shelters for guns and personnel be deep. In the Somme, shelters were from 18 to 32 feet deep.

Observatories must be provided. They are arranged to permit observers to be in prone position, and for either direct or periscope observation.

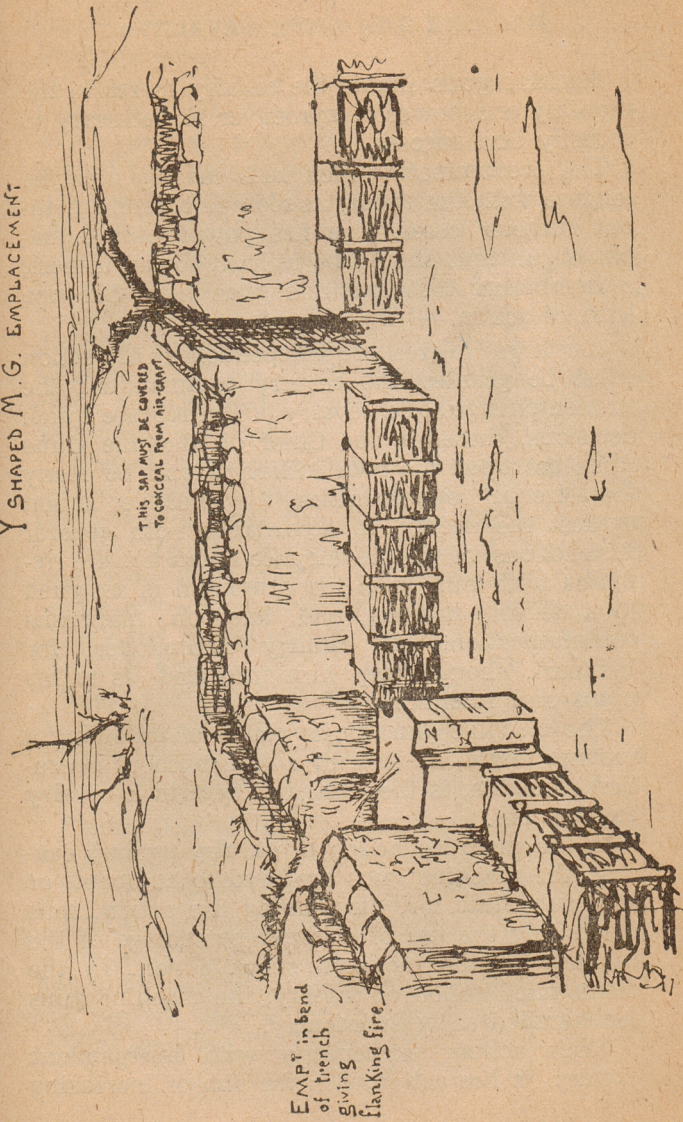
All embrasures should have screens, and, if necessary, artificial backgrounds, as well. Guns are frequently painted in patchwork colors for concealment.



M.G. Empt. in front of trench
giving flanking fire with passage
covered over



Y SHAPED M. G. EMPLACEMENT



EMPT. in bend
of trench
giving
flanking fire

MACHINE GUN WITH CAVALRY:

Machine guns enable the cavalry to retain the mobility and power of maneuver so necessary to security and success.

The predominating idea with cavalry must be to close with the enemy as soon as possible without ruinous losses. The fire power of the machine gun unit should be utilized to the utmost, remembering that machine guns have but one kind of action — *fire*.

“A large degree of independence of action must be granted the cavalry commander; the sudden changes of a cavalry action require quick decisions, therefore the Chief of Machine Guns must act upon his own initiative, and be ready to seize all opportunities for effective action against the enemy, in accordance with general instructions of the cavalry commander. He remains with him until his command is assigned to a definite mission, and, later on, maintains communication. The cavalry commander, for his part, should keep him informed as to his plans and intentions.”

The machine gun, by its power of following a moving target, by turn of wheel, without alteration of sights, is the ideal fire arm in a cavalry engagement.

In the mounted action of cavalry against cavalry, the machine guns are used to augment, or as a substitute for, dismounted fire action, thus permitting the use of a larger percentage of the cavalry for the mounted shock action. In the dismounted action of cavalry, the machine guns are handled as with infantry.

Their action, particularly with independent cavalry, is fire action, with the aim of increasing

the offensive and defensive power of mounted troops, and facilitating the execution of their tactical mission.

The machine gun unit may be used in the attack as a *pivot of maneuver*, or disposed so as to cover possible rallying points with its fire. It should never be placed in such position that its fire will be masked by the advance of the attacking line.

When cavalry advances for the attack, the machine guns should be pushed well forward, so as to prepare the way. Should the attack fail, the machine guns must remain in action to cover the retirement. If the attack is successful, the machine guns must be pushed forward rapidly, to assist in the pursuit.

When the machine guns can be concealed, the cavalry should endeavor to draw the hostile troops under their fire. This maneuver may be accomplished by placing the guns at the rear or unexposed flank element of the cavalry, which, acting as a screen, drops off the guns under cover as selected, while the cavalry maneuvers for position or action.

The flank attack is the favorite maneuver of the cavalry. The flanks of attacking cavalry are its weakest parts. Machine guns echeloned on the flanks, afford efficient protection.

During the cavalry battle, machine guns fire on that portion of the hostile cavalry against which the decisive charge is to be delivered.

During the mounted attacks against the flanks of dismounted troops, or artillery, machine gun fire from the front may hold the enemy in place, and prevent his changing position to face the attacking cavalry.

Machine guns echeloned on the flanks of cavalry may fire to the front, or bring cross and enfilade fire to bear on the enemy's lines, or quickly change direction so as to fire toward the flanks.

« When machine guns are employed to support a cavalry charge, the concealment of the guns in the fire position is of minor importance. The chief object is to keep them hidden until such moment as they can be brought into action suddenly, from a position whence the fire of every gun can be concentrated on the enemy just before the moment of shock. »

To effect this, the machine gun commander must act with promptitude and decision, and must clearly understand his commander's plan of action.

When the fire becomes masked by the advance, the machine gun commander must be on the alert for opportunities to fire on the hostile supports and reserves, and to assist his own cavalry when it is re-forming after the melee.

NOTES ON THE EMPLOYMENT OF MACHINE GUNS IN OPEN WARFARE :

Trench warfare is but one phase of operations, and a definite decision will be gained only when the enemy is crushed in the open.

On the Service of Security :

The guiding principle of the use of machine guns on the service of security is that their function is not to seek a decision, but to force a premature deployment, or otherwise to delay the enemy.

The machine gun is peculiarly well adapted for this service by reason of :

Great fire power from narrow front.

Effectiveness of this fire at ranges where rifle fire is least effective.

Ease of control.

Mobility.

Short road space occupied on march.

Rapidity with which deployment can be effected and fire opened.

With Advance Guards :

Great fire power should be quickly available. Automatic rifles should be with the vanguard, and machine guns with the support or reserve.

The automatic rifles and machine guns of the advance guard are used to :

a) Force the enemy to deploy at long range, thus delaying his advance.

b) Assist in the holding of important ground until the arrival of supporting troops.

c) Cover the deployment of the main body, and

In general, to carry out the aggressive mission usually assigned to the advance guard.

With Rear Guards :

A large proportion of machine guns should be allotted to the rear guard of a retreating force.

This assignment reduces the number of infantry required, and increases the fire power which is necessary to check a pursuing enemy.

The guns are especially valuable for delaying the enemy at river crossings, in defiles, etc. The guns should be echeloned to fire to the front, or

toward the flanks. Concealment is highly important. Surprise effect is essential. Positions in rear should be chosen before retirement, and covered lines of approach thereto selected. Automatic rifles should ordinarily be with the rear party, and machine guns posted to employ covering fire. Retirement from forward positions should be progressive, and, as machine guns are helpless when limbered up, or in park, should be covered by the fire of other guns. Ammunition wagons (combat trains) or packs, should be kept ready for immediate retirement, preceding that of the guns. This method results in « *Retirement by successive positions* ».

Delaying Action : The *Machine Guns* should be assigned to positions whence they will be able to concentrate long range fire on closed bodies of the pursuing enemy, force his early deployment, and cover the withdrawal of our own troops.

The *automatic rifles* are well adapted to the covering of the flanks.

When making a flank march in the presence of the enemy, a large proportion of automatic rifles and machine guns should be assigned to the flank guard.

It must be borne in mind that a burst of fire delivered as a surprise, on a closed body of troops, will do more to delay the pursuit, and render pursuers cautious than any number of defensive positions, however stubbornly held.

Outposts :

The general methods of employment for open warfare are the same as for trench warfare. As open warfare requires movement, machine gun

units, — platoons at least, — should be kept intact, and ready for instant movement.

In the outpost, automatic rifles and machine guns should be posted in, or in rear of, the line of resistance, to cover the principal lines of approach, and to check sudden advances of the enemy. Automatic rifles are valuable for detached posts. Preparations should be made for night firing, and emplacements should be constructed. Positions for the machine guns should be selected first, and the positions of the other troops fitted to the plan.

The Attack :

Automatic rifles now form an integral part of each infantry company, and each infantry battalion includes a company of machine guns. The automatic rifles that go forward with the attacking infantry are under the orders of the battalion commander. The remaining guns, or those used to support the attack by covering fire, are under the control of the machine gun company commander, acting under the orders of the brigade, or other commander charged with the direction of the attack.

In the absence of brigade or division machine guns, some of the guns of the machine gun companies may be held as a brigade reserve.

The early development of great fire power, and the attainment of fire superiority are the controlling factors, and all available guns may have to be put into the action during the early stages of the attack.

Automatic rifles that go forward with the attacking infantry are accompanied by bombers. In open warfare, where the attack is made over

long distances and the enemy's position is hastily intrenched, automatic rifles will accompany the leading lines. Their purpose is to augment the fire power of the attacking infantry. They economize infantry, and can command ground which cannot be covered by the fire of the supporting machine guns. They assist in the consolidation of the position won, or cover the retirement of our own infantry.

The machine guns of the battalion provide covering fire for the attacking troops. This may be done by fire from the flanks, by overhead fire, or by long range searching fire. Concealment of guns is all important. Positions for indirect fire must be sought.

If guns are shelled, a change of position, or a temporary cessation of fire will often relieve the situation. On the march, or during the advance, the machine guns should conceal their presence by taking shelter when practicable, otherwise, by adopting the formations of the troops with whom they are operating.

Machine guns cannot contend against artillery in position, but can be used very effectively when guns are in march, or limbering or unlimbering. As in the case of other targets, enfilade fire gives the best results.

During the Russo-Japanese war, six machine guns opened a sudden fire on a Japanese mountain battery in march, and annihilated it in one and one-half minutes. Many instances are recorded of successful employment against artillery in the present war.

The successful handling of machine guns in action depends upon close cooperation between the guns and the other arms, and a thorough

knowledge, on the part of the machine gun commanders, of the plan of action.

The Defense :

Positions for the machine guns are selected first, and the other troops placed, with these as a framework. Positions for cross fire, and belts of flanking fire should be selected along the front of the position. All folds of ground, and lines of approach should be covered by machine guns. Emplacements for the automatic rifles may take the form of *firing places*, such as loop holes or depressions in the parapet. These should be well protected, and defiladed from the front. Certain fronts should be allotted to the automatic rifles. Shelters for the personnel should be provided, and the guns kept under cover during bombardment. Crews must be ready to place guns in action without delay. Automatic rifles provide a powerful reserve of fire.

The automatic rifles and the machine guns must cooperate as to time of firing and targets fired on, or areas swept.

The machine guns held in rear of the front line prepare data for overhead covering fire, long range searching fire, and night fire. Emplacements are prepared in rear of the front line, and guns detailed for their occupation.

Positions in rear must be selected for use in case of withdrawal. Gun crews must be familiar with the location of, and routes to, these positions. In case of withdrawal, guns in rear cover the movement by the occupation of successive positions. (See rear guards.)

The crisis of a defensive action is the hostile assault. An abundant supply of ammunition

must be on hand at all times, in order to meet a crisis. Definite arrangements must be made to secure a continuing supply.

Range cards should be prepared for each position.

Positions for night firing should be prepared.

A system should be established for the replacement of casualties.

Arrangements should be perfected for the assumption of the offensive.

Occupation of Various Positions :

The narrow front required for a gun and crew enables them to make use of fire positions which do not afford room for the riflemen necessary to produce an equal volume of fire. Examples: ditches, holes in a wall, small mounds, trees, shell holes, salients, etc.

Frequent use is made of houses for firing from doors, windows, holes in the roof, cellars, etc. Houses are also used for overhead fire, and for observation posts.

Woods and crops afford cover from view. Machine guns may be easily concealed in ploughed fields, especially if there are piles of manure or rubbish. It must constantly be borne in mind that concealment is essential to surprise (and safety), and that the effectiveness of fire is largely dependent upon surprise.

Village Fighting :

Machine guns are most formidable in this class of fighting. They have been used from every conceivable position.

In the attack of a village, infantry units, automatic rifles, and bombers, precede the main force,

to search houses for snipers, and to clear out concealed machine guns, barricades, etc. Machine guns are posted in buildings, and on roofs to cover the advance of these troops.

A portion of the advance troops, with automatic rifles, push through the village in order to organize the far end and the flanks. Other troops on the outskirts command the exits. Machine guns are used to command the streets and the outer faces of the village.

BY COMMAND OF BRIGADIER GENERAL PARKER :

MALVERN-HILL BARNUM,
*Colonel, General Staff,
Chief of Staff.*

— GS —

HEADQUARTERS SOUTHERN DEPARTMENT
TRAINING OFFICE
FORT SAM HOUSTON, TEXAS,
August 5, 1917.

APPENDIX I

TRAINING MEMORANDUM No. 8.

CONFIDENTIAL

Much of the matter contained in this paper is from foreign sources, and is of a confidential nature. Quotation or publication of it is not authorized.

1. Attention is invited to page 42 of Training Memorandum No. 8.

The method described is recommended for use on moving targets in the neighborhood of the aiming mark. It should be remembered that it is subject to error, which may be considerable, if its use is attempted under other circumstances. (See Page 17.)

Ordinarily, the sheaf will be placed as near to the target on the first burst as would be the case if an attempt were made to estimate the difference in range of target and aiming mark, and to apply this difference to the sight setting as a correction. The chief advantage of the method is the promptness with which fire can be opened upon the appearance of a moving target in the sector.

2. Additional notes on Machine Gun Barrage.

The machine gun barrage is dropped just beyond the nearest artillery barrage, and moves forward step by step just in advance of the troops. The fall of the artillery barrage is easily visible, both to the troops and the machine gun men, and affords an aiming mark to the latter. The range of the initial fire is generally from 2000 to 2500 yards, and the barrage should first fall about 500 yards in front of the first line trenches. This necessitates great care to insure the safety of our own troops at each successive stage of the advance. When the extreme effective range of the machine gun barrage is reached, the troops will have reached their first objective. It now becomes necessary to advance the machine guns. This is done by echelon, under the cover of the artillery barrage, and the direct fire of the rifles and the automatic-rifles which accompanied the leading elements of the attack. The machine guns occupy advanced positions which permit

them to create a barrage for the purpose of covering the second forward movement of the infantry. No assault is possible, without machine gun barrage.

While the artillery is engaging the trench lines, the machine guns sweep the area beyond them to :

Keep down fire of hostile machine guns.

Prevent the forward movement of hostile reinforcements.

Hinder intended counter attacks :

To form an effective barrage on an area of ground, frontal fire should generally be used, and the guns must be close enough together for easy control. Each gun should cover about forty yards of front. A traverse of $2\frac{1}{2}$ mils at each burst insures the proper overlapping of the cones of fire. The guns work in pairs, each gun covering its own sector, and overlapping adjacent sectors. In the event of a gun having a stoppage, the other gun of the pair fills the gap.

During the assault, all points in the enemy's defenses, from which fire can be brought to bear, are smothered. This involves the covering of the whole front of the attack, and frequently as much as 800 to 1200 yards to either flank, according to the terrain and the trace of the trenches.

It is of paramount importance that all suspected machine gun emplacements, which are not destroyed by the artillery bombardment, should be subjected to constant fire. One hostile machine gun in a flank position may jeopardize the success of the whole operation.

After the attack is launched, heavy fire must be kept up on the immediate flanks.

The lifts of the barrage must be carefully

timed, and should be very gradual, to suit the pace of the infantry.

In case of a counter-attack, — and this is a war of counter-attacks — the barrage should be dropped right across the front. Guns should be retained «in observation» for this purpose. When the ground is under observation it is not necessary to fire until the target is actually seen advancing. In case the ground is not visible from the machine gun observing station, short bursts of fire will probably have the desired effect.

«A fixed machine gun barrage permits, in normal times, a very considerable economy of artillery ammunition: and its effect is at least as sure, and is more demoralizing by its continuity than that of cannon.»

In defense, the above principles hold good. Machine guns must be ready to respond to the alarm, on special barrage signal.

Note. — The above is based on information recently received from abroad. Firing at the extreme ranges involved has not been carried out in our service.

3. Notes on Dealing with Hostile Machine Guns in an Advance.

(These notes are from a foreign source, under date of April 1917. They are printed almost verbatim.)

1. At the present stage of operations (April 1917) one of the enemy's chief methods of defense consists in holding strong points immediately in rear of his defensive systems. These strong points usually contain one or more machine guns which are echeloned (checker board formation) so as to be mutually supporting. They are

frequently concealed in hollows, so as to be difficult to detect from the air, and for artillery to deal with.

2. On being compelled to fall back from any organized system of defense, the enemy usually does so covered by small infantry rear guards which hold tactical points. These rear guards are, as a rule, armed with machine guns.

3. In the circumstances referred to in either paragraphs 1 or 2, there is often at first no definite objective for attack after a successful assault. To continue a general advance under these conditions in attack formation, as has sometimes been attempted, is therefore usually not advisable. Small tactical units should be pushed well forward charged, among other duties, with locating, and, if possible, dealing with hostile machine guns.

4. If the reconnaissance of these advance guards discloses a situation such as is outlined in paragraph 1, it may be necessary to delay the operations until adequate artillery preparation can be made, possibly including a creeping barrage. If, on the other hand, the reconnaissance discloses a situation as outlined in paragraph 2, such delay is quite unnecessary for the reason that the weapons in the hands of the infantry should be sufficient to deal with the situation.

5. When hostile machine guns have been located, information should be passed as quickly as possible to any artillery that may be within reach and able to assist. This information should also be passed to Machine Gun Commanders, who must act with boldness, making every

effort to engage the hostile machine guns, and provide covering fire for the advance of the infantry and *light trench mortars*. This can be effected, even if the exact position of the hostile machine guns has not been accurately located. The employment of cross fire, from two or more sub-sections of machine guns; to sweep the suspected locality by means of either direct or indirect fire has proved very successful. (*Note.* — A « sub-section » is believed to be two guns.)

6. In addition to any aid which artillery and machine guns may be able to afford, the various weapons with which the infantry is now armed should be used in combination to cope with such situations.

(a) The automatic riflemen should open fire from the nearest cover available. It has been found that, if they open fire first, the German machine gunner will almost always direct his attention to them, and, owing to the apparently limited traverse of the German machine gun, it may then be possible for the riflemen and grenadiers to work around either flank to reach a position for effective use of their particular weapons.

(b) The riflemen should endeavor to gain a position on the flank, from which to attack with rifle fire or bayonet.

(c) The rifle grenade, used in cooperation with the automatic rifle, the rifle, and the hand grenade, has been successfully employed on many occasions in recent open fighting. (April, 1917.) Provided that cover can be given by the fire of the riflemen and automatic riflemen, rifle grenadiers have been able to approach within range, and by a sudden and rapid barrage, have

either knocked out the machine gun or its detachment, or made it withdraw, or enabled the riflemen, automatic riflemen and grenadiers, (hand), to advance.

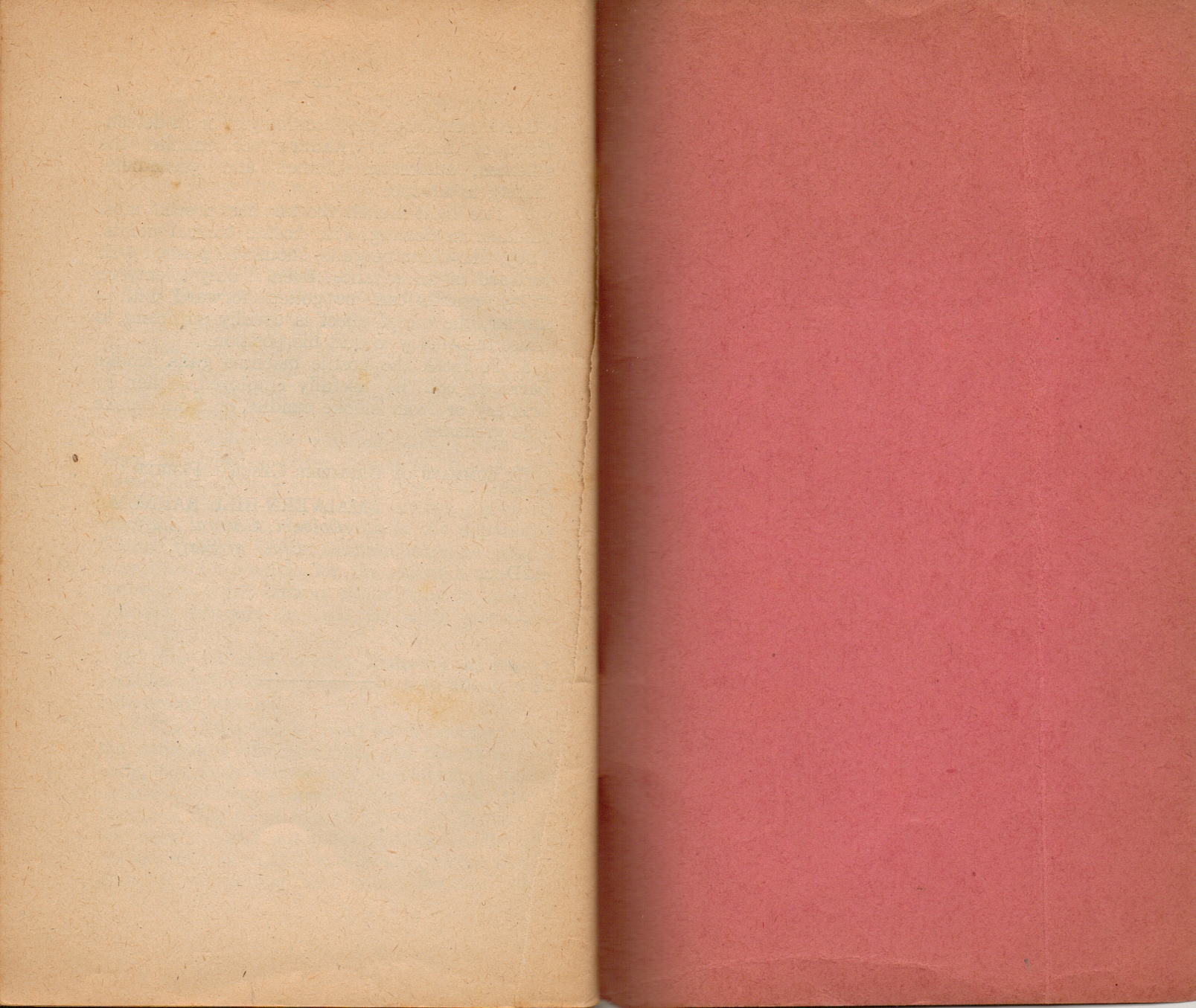
7. The light trench mortar has proved most valuable in dealing with hostile tactical points. They, like machine guns, should be pushed well forward in an advance. Even if only twenty or thirty rounds can be gotten forward with a mortar, the moral effect is usually sufficient to cause the enemy to quit his position.

8. To mask the hostile machine guns, smoke barrages can be usefully employed, either by artillery or from smoke candles or from smoke rifle grenades.

BY COMMAND OF BRIGADIER GENERAL PARKER :

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Colonel, General Staff,
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